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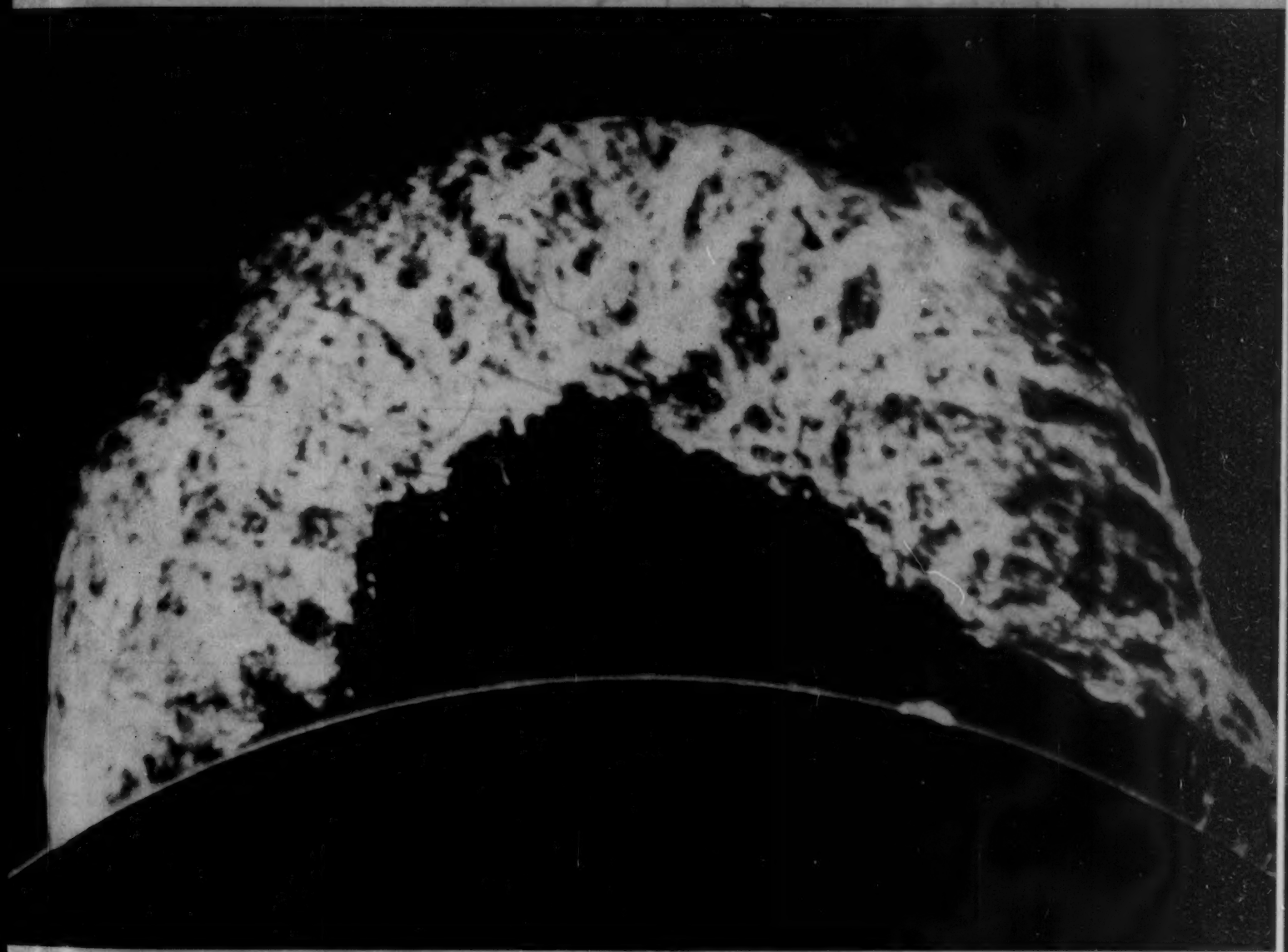
Sky and TELESCOPE



A prominence on the sun.

★

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AUGUST, 1946
Whole Number 58
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In This Issue:

Convention at Cranbrook

The End of the World

Concerning the Sun

The Indomitable Mr. Flamsteed

Northern and Southern Star Charts

The Mason-Dixon Line

FEW ASTRONOMERS are credited with being familiar with Charles Mason and Jeremiah Dixon, whose names title an article by Thomas D. Cope, of the University of Pennsylvania's department of physics, in the June number of **The Scientific Monthly.** This is a very entertaining account of the completion of a problem in geodetics and surveying which had assumed serious proportions when these men came into the picture fresh from making observations of the 1761 transit of Venus for the Royal Society of London. The article is quite complete in its presentation of both the historical and technical aspects of the story; only very few points can be stressed in this note.

From 1756 to 1760, Charles Mason was assistant observer to Astronomer Royal James Bradley, who died in 1762. Mason was closely acquainted with Nevil Maskelyne, who became Astronomer Royal in 1765. These two men "made the development of the method of lunar distances for finding the longitude at sea a major concern of the rest of their lives."

Jeremiah Dixon was an amateur astronomer who was selected to observe the transit of Venus with Mason; they were to go to Sumatra, but got only as far as the Cape of Good Hope. In 1891, when Simon Newcomb reviewed the transits of 1761 and 1769, he gave very high weights to the 1761 observations of Mason and Dixon.

These men were experts in determining latitude by measuring the zenith distances of stars (using Bradley's positions). When they were called to America they brought with them a zenith sector built by John Bird for Thomas and Richard Penn, and this they used for all their measurements of latitude in this country.

Ten years earlier, arbitration appears to have played its part in solving the differences between the Proprietors of Maryland and Pennsylvania, for "the Middle Point of the peninsula between Delaware and Chesapeake bays had been determined, accepted, and marked in 1751. It is now the southwestern corner of Delaware. The eastern boundary of Maryland . . . was agreed upon as a straight line northward [not necessarily due north, however] up the peninsula from the Middle Point until it made a tangent to the periphery of a circle of 12 miles radius drawn around New Castle. From the Tangent Point northward the boundary should consist, first, of that part of the circular arc that might lie westward of the meridian through the Tangent Point, and thence northward the meridian of the Tangent Point to an east-west line 15 miles south of the southernmost point of the city of Philadelphia. Except for slight errors made in surveying this describes the boundary as it stands today."

Here we learn why Delaware has that peculiar circular sector in its boundaries, as well as why the southern boundary of Pennsylvania is a straight line 15 miles below the "south point of Philadelphia." All but about 36 miles of that famous line were run by Mason and Dixon, who arrived in Philadelphia on November 15, 1763, and sailed back to England on September 11, 1768. In this period, they not only did all the surveying required by Maryland and Pennsylvania, a job which the provincial surveyors were unable to do successfully, but they measured the length of more than a degree of latitude — the first such distance to be measured in North America. Their work maintained and even set the standard for precision in the geodetic surveying methods of the day.

Carrying on his work, in 1773 Mason measured the deflection of the plumb line by observations on the north and south sides of Schehallien hill in Perthshire, Scotland. Mason worked for many years for the **Nautical Almanac,** which had been established by Maskelyne in 1767, Mason's outstanding success being his revision of Mayer's tables of the moon. Mason's tables of 1780 were published in 1787, although he had come with his family to Philadelphia in 1786, where he died that year. Dixon died in 1779.

These men and Maskelyne were elected to the American Philosophical Society, and it is with the aid of a current grant by this organization that Dr. Cope has collected a large bibliography (listed in **The Scientific Monthly** account), published seven articles, and delved into all the lore surrounding the Stargazer's Stone set by Mason and Dixon in 1764 on John Harlan's farm, where they established an observatory 31 miles west of the South Point of Philadelphia. This farm lies 538,067 feet north of the Middle Point, for which Mason and Dixon found a latitude distance of 1° 8′ 45″.

That practical astronomy can be romantic and play its part in the lives and fortunes of people to a considerable extent is well illustrated by Dr. Cope's account, in which there are many references to other persons and scientists prominent in those times. There is something of the history of an astronomical clock made by John Shelton, a clock which did everything from measuring the earth's shape to timing transits of Venus; there is mention of how the Indians delayed running of the line to the west of the Monongahela River; and there is a good deal of material about the famous navigational problems of the day. C. A. F.

Sky and TELESCOPE

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BACK COVER: A portion of the moon near first quarter, from a Lick Observatory photograph taken with the 36-inch refractor by J. H. Moore and J. F. Chappell. The reproduction is reduced 10 to 7 from a 7.8 enlargement of the original negative. (See In Focus.)

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The Fourth National Convention of Amateur Astronomers. Photographs in this article are by Harvey Croze.

CONVENTION AT CRANBROOK

BY MARGARET BACK, *Detroit Astronomical Society*

Auntie, did you feel no pain
Falling from that willow tree?
Would you do it please again
'Cos my friend here didn't see?

WE ARE INDEED SORRY but, like the above-mentioned Auntie, we cannot do it again because all those who attended the Fourth National Convention of Amateur Astronomers on July 5th to 7th have gone their many ways to the Pacific Coast, the Atlantic Coast, to Florida and Mississippi, across the borderless borders to Ontario, and back to all the states between. To those who were unable to attend the convention we all extend our sympathies, for everything combined to provide, for the 160 strong who did attend, perfect convention conditions and cloudless skies for observing and the trips to Michigan's two largest observatories.

Many unheralded amateurs appeared on the first morning at registration time, with the eager question, "Can I have a room?" The quota allowed us had already been filled and reservations closed. However, the hearts around Cranbrook are generous and they permitted all who came to be housed and fed. It had been expected that shortage of help would prevent serving meals to everyone, although the spacious dining hall seats over 200, but at the last moment the young women students who were in residence at the Cranbrook School of Art volunteered their services, which proved more than adequate to the occasion.

The man who suggested a daily bulletin might have supplied an additional want if he had run an "agony column" in its pages, for the writer, as chairman of the convention committee for the Detroit astronomical societies, felt entirely unable to cope with the distracted inquiries for mail from absent husbands, phone calls for the men, and entreaties such as, "Do you know who the tall, dark man from . . . is? Do try to find out for me!" Next convention, please note this suggestion.

This Fourth National Convention was primarily concerned with the problem of national organization among amateurs, which has been the subject of discussion at previous conventions. In 1941, the proposed Amateur Astronomers League of America had been tentatively ratified by nearly a dozen societies, but the war intervened before final organization could take place. At the first session at Cranbrook, held on Friday morning, July 5th, Charles A. Federer, Jr., gave a brief account of the prior work. He also described a recent proposal by a committee of the American Association of Variable Star Observers to form a national astronomical society.

At this first session, the convention voted to retain the elements of the proposed A.A.L.A., but to include membership by individuals and by junior astronomy groups, and also to make provision for activity sections to carry on amateur observations and research of value to professional astronomers. A committee of 12, with Mr. Federer as chairman, and including amateurs present from all parts of the country, was charged with synthesizing the multitude of earlier proposals. This committee made its report late on Saturday afternoon, and on Sunday morning at the closing session the revisions were discussed and some final changes made by the convention.

It was decided that the name would be Amateur Astronomers League. This is concise, descriptive, and easily understood; it does not exclude members from other countries; memberships by local societies, national organizations, and individuals are all encouraged. Every type of amateur astronomer will be included. Each individual will have an opportunity to join the local group in his vicinity and thereby become a League member, or to join the national organization directly. Semi-professional and serious amateurs can carry on research programs under the activity sections, which will be guided by an advisory council of professional astronomers.

After considerable discussion, the highly controversial question of including activity against astrology among the purposes of the League was decided by a very one-sided vote. All reference to the matter was eliminated from the proposed by-laws.

The League will commence functioning when ratified by 10 societies. The committee was requested to circulate the proposed by-laws among all known groups for immediate ratification, with proposals for further changes to be considered by the national council of the League after its formal organization. Dues for individual members-at-large were not set, and this will be one of the first problems for the new council. Dues for organization members, as societies which join the League are to be called, were set at 15 cents per year per individual member of such societies, but not

less than five dollars nor more than 40 dollars for each society. The initiation fee for societies is three dollars each. In most other respects the new by-laws follow the A. A. L. A. proposal, but with considerable expansion of the parts concerning the organization of the country into various regions where regional activities and conventions may be carried on.

So much for the business of organization. The convention program was a busy and breathless one, with considerable time spent discussing amateur activities. Unfortunately, delays in the arrival of delegates for the opening session did not permit the scheduled tour of exhibits at the Cranbrook Institute of Science, but these received adequate inspection by the delegates whenever they had opportunity. Dr. E. T. Boardman, acting as director in the absence of Dr. Robert T. Hatt, delivered a welcome to the convention.

More welcomes were in order at the McMath-Hulbert Observatory that afternoon, where we were smilingly received by Drs. O. C. Mohler, Leo Goldberg, and Helen Dodson. Also acting as hosts were John T. Brodie and Judge H. S. Hulbert, one of the observatory founders. Absent director Robert R. McMath sent us a telegram of greeting from California, where he is on an assignment for the National Research Council.

Three times the latest spectroheliokinematograph pictures of activity on the sun, and motion pictures of the moon, Jupiter, and Mars, were shown. Even at that, standing room only was in evidence at the back of the room for each showing. Meanwhile, the other two thirds of the convention wandered at will through the 50-foot solar tower used for the solar phenomena pictures, and through the laboratories and lower portions of the 70-foot tower used at present for solar spectrum studies. The observatory's first dome houses a 24-inch Cassegrainian reflector which is used for visual work and photography of the moon and planets, and is equipped with special electrical controls to enable precise guiding on these erratically moving bodies.

The Paricutin volcano color films Friday evening drew an audience of 200 and were enthusiastically received. Dr. Otto O. Fisher, who has collected them for the National Archives, and Dr. Clyde Fisher, honorary curator of the Hayden Planetarium, are two most popular brothers. Observations with everyone's portables followed the film; the Cranbrook 6-inch refractor was manned until midnight by William Schultz, Jr., president of the Detroit Astronomical Society, who is on the faculty at the Cranbrook School. Nevertheless, he looked fresh as a daisy as he rang the gong in the dining hall at breakfast the next morning and gave his customary "I have an announcement to make." After a few repetitions, this became one of the signals to cheer, especially when we were told we did not have to vacate our rooms on Sunday morning by 9:30 o'clock.

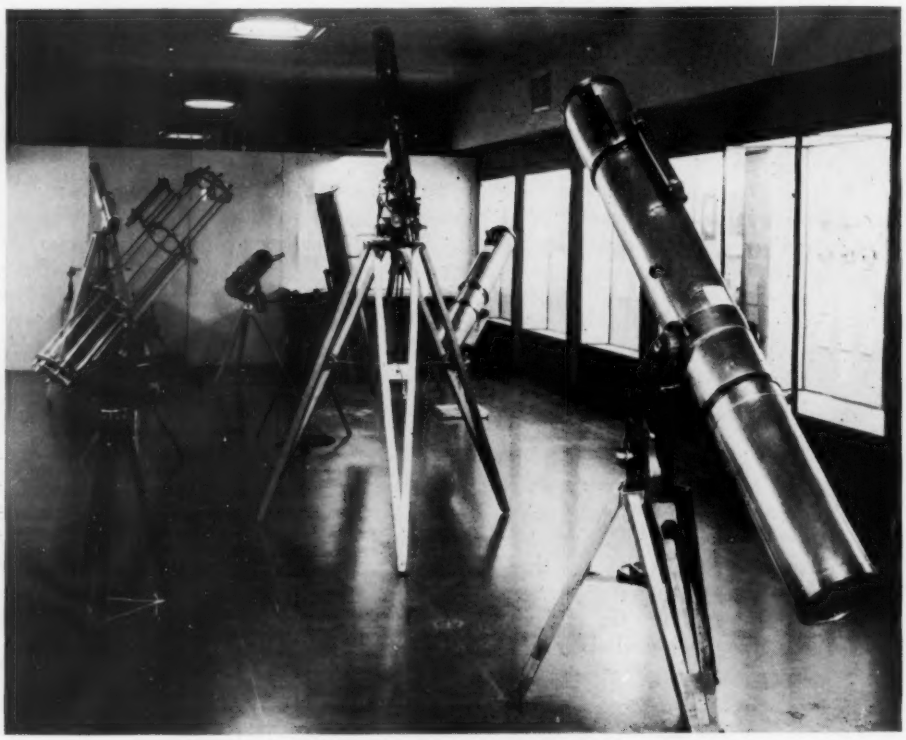
Carl H. Gamble, of the Popular Astronomy Club, Moline, Ill., acted as chairman of the second convention session Saturday morning. If time and space were as relatively boundless for this article as they are in the universe, it would be a delight to tell of all the doings reported at this session.

R. S. Young, of Mr. Gamble's own group, told how the Popular Astronomy Club has a transportation committee with eight captains responsible for having everyone taken to and from the observatory which houses their telescope. This society would like to exchange films with other clubs. Jack Patterson, Burnham Astronomical Society of Chicago, described their monthly meetings in a public building in Lincoln Park, followed by outdoor observations with their own telescopes. Paul W. Stevens, of Rochester, N. Y., reported that his society has reorganized and revived since the war. They have joined the Rochester Academy of Sciences; each section puts on one meeting a year for the entire membership. Charles Strull, of Louisville, Ky., is primarily interested in disseminating information to the general public. The Louisville group works closely with the Natural History Society there, as well as with other science groups.

George V. Plachy, of the New York City amateurs, reported that his society will celebrate its 20th anniversary next year; it was founded in 1927 for the purpose of obtaining a planetarium for New York. A tremendously inspiring color film, taken by Peter Leavens, was shown. This "documentary" motion picture includes most of the activities which are regular features of the New York program: lecture meetings, field trips, the optical shop and machine shop in the Hayden Planetarium basement, and a lunar camera station on Long Island.

Edward A. Halbach, of the Milwaukee Astronomical Society, described their 13-inch reflector, situated in an observatory 14 miles from the heart of Milwaukee. Mr. Halbach, as chairman of the auroral work of the National Geographic Society in his region, sent out a call for volunteers to help in auroral observing. This work requires no optical or mechanical apparatus and no great experience.

With Miss Mabel Sterns, of the National Capital Astronomers, in the chair, publicity methods for amateur groups were discussed. Miss Sterns said: "Get a newspaper editor on your side for publicity in his paper. Get radio stations lined up. To get publicity you have to do something. Send out advance notices of what is going to happen and what you propose to do." To this various delegates responded by describing their membership and publicity methods; these included the window display of the Portland A.T.M.'s, the guest book of the Detroit Astronomical Society, the hobby-lobby show of the Norfolk, Va., amateurs, and the posting of notices on government agency bulletin boards by the Washington, D. C., society.



The exhibit of amateur-made instruments and photographs.

Later in the day, when the question of where to hold the 1947 convention came up, Miss Sterns was made chairman of a committee to consider invitations from amateur groups desiring to conduct the Fifth National Convention of Amateur Astronomers, presumably on July 4th to 6th, 1947. Many of the delegates at Detroit reported that their societies had not quite recovered from the effects of the war, and that they wished to have opportunity to consider extending invitations sometime this coming fall or winter.

At the Saturday sessions, motion pictures were shown by Mr. Stevens of the eclipse in Canada last year, and by Mr. Plachy of the eclipse expedition to Helena, Mont., by the New York amateurs. In addition, Mr. Stevens showed some kodachrome slides of his trip. Carl P. Richards, of Salem, Ore., representing both the Portland A.T.M.'s and the Astronomy Study Group, showed slides and pictures of the 1945 eclipse as he observed it in Wolseley, Sask.

It is almost trite to remark how kind and friendly is the professional astronomer to the humblest amateur, without exception. At Ann Arbor on Saturday evening, as also the day before at Lake Angelus, professional astronomers devoted themselves untiringly to the entertainment and instruction of the convention delegates. On arrival at the Observatory of the University of Michigan (our four chartered busses and several cars made an imposing cavalcade), Dr. and Mrs. Dean B. McLaughlin, Dr. Mohler, Dr. Hazel M. Losh, and Messrs. Robert M. Paige and Lyle R. Langdon greeted us and stayed at their posts until the last amateur had been satisfied. Dr. W. C. Rufus, professor emeritus of the Michigan astronomy department, drove with us back to Ann Arbor, having remained at Cranbrook after the banquet which took place at noon.

We crowded at the 37½-inch reflector to see how Dr. McLaughlin used it for taking a spectrum of a star, and later felt honored to be the first group to use the new eyepiece that permits the instrument to be operated visually. The Hercules cluster and the Ring nebula were remarkably clear. The 12-inch refractor, operated by the newly-appointed Michigan astronomer, Dr. Freeman D. Miller, was used on Mars, Jupiter, and the moon. Dr. Losh, at the students' observatory atop Angell Hall, generously took a group up on the observing roof and pointed out constellations, and directed use of the 10-inch refractor.

Sunday morning the amateur telescope makers discussed problems which appeared to be of great interest even to those not optically minded. L. H. Sprinkle, president of the Northwest Astronomical Society of Detroit and chairman of the exhibits committee, described the process of aluminizing a mirror, and answered many questions concerning preparation of a mirror for surfacing as well as care after use. He advised amateurs to have a very high polish on mirrors before getting them coated, and stated that often a poor finish could be traced to a poor polish. Mr. Sprinkle advised strongly against the use of soap of any kind in cleaning an aluminum surface.

Richard S. Luce, chairman of the Optical Division of the Amateur Astronomers Association, New York, discussed mountings and other problems, and answered questions from the floor. A serious lack of eyepieces was reported by many amateurs. A standard mounting for amateur instruments was discussed. Mr. Strull stated that his society was again working on its 20-inch mirror and wanted suggestions for mounting it. He asked for a general consideration of the subject by mounting designers, inasmuch as many other societies with 20-inch blanks must also be working on them.

The exhibit of amateur instruments, photographs, and miscellaneous items was unexpectedly good, considering the shortness of the advance notice. Mr. Sprinkle and the judging committee, which included Dr. Mohler, not only inspected instruments indoors, but took the telescopes outdoors Friday evening to test their actual operation and performance on the stars. Awards were made in each of the five classes of exhibit.

To end this bird's-eye view of a thoroughly happy and constructive and busy convention, let us turn to the delightful banquet held on Saturday at 12:30 p.m. Sunny skies, summer attire, and a perfect menu put guest speakers and convention members alike in a gay mood. When speech time approached, Dr. Everett R. Phelps, of Wayne University and an honorary member of the Detroit Astronomical Society, acted as a very skillful toastmaster.

Dr. Boardman generously told of the pleasure it had given the Cranbrook institutions to house the convention. Mr. Schultz outlined the history of the Cranbrook Foundation, which was begun by George G. Booth, who came over here as a lad from Cranbrook, Kent, England.

Dr. Rufus, professor emeritus of the Michigan astronomy department, acknowledged that Mr. Schultz and several others present, including this writer, had been his children in class, and that since a thriving junior group was in attendance, he now greeted his grandchildren. A rising vote was accorded him, after which he read an astronomical poem entitled "Spark," which had been dedicated to him, but which space does not permit our including here.

Dr. McLaughlin gave some enjoyable anecdotes of the effects of dread

Junior astronomers at the convention. Joan Oberem tries out one of the amateur instruments, with Janet Anderson in back of her, and Joanne Anderson at the right.

of the atomic bomb on physicists. Dr. Phelps told of the observational work shared by the members of the Detroit Astronomical Society, who acted as hosts at their homes, with their telescopes in readiness for his astronomy students at Wayne University. William Kapp spoke on the present status of plans for a planetarium in Detroit. It is probable that this aim can be realized by constructing the planetarium as an adjunct to the new Detroit Historical Museum.

Cranbrook will long live in the memories of nearly 200 amateurs, not only for the hospitality of the institutions there, not only for the hasty dips in the marvelous swimming pool, but for the fellowship and communion with others who look to the stars, and for the hope of things to come. Perhaps there is room, after all, for the last verse of "Spark":

Surely in the future far
Man himself will be a star,
Shining by eternal light
Guiding pilgrims through the night.

CRANBROOK ATTENDANCE

From Mr. and Mrs. F. W. C. Jones, of Trenton, Mich., members of the reception committee of the host societies at Cranbrook, a list of those who registered has been received. In addition to the numbers given here, a dozen or more persons attended without registering.

As expected, Michigan had the largest representation, with 46 persons from Detroit, and 33 more from other widely scattered parts of the state. From New York and Ohio each came 17 amateurs; from Illinois, 10; from Indiana and Wisconsin, six each. Four persons each represented Kentucky, Massachusetts, and Pennsylvania, while Washington, D. C., and Windsor, Canada, sent three delegates. From Connecticut the attendance was two, and there were two from Oregon. The following states were each represented by one person: Florida, Iowa, Maryland, Mississippi, Missouri, New Jersey, and Virginia. In all, 164 persons registered for the convention at Cranbrook.

ASTRONOMICAL ANECDOTES

CAPITALIZATION, TRAFFIC LIGHTS, THE PETERS CASE, DOLBEAR AND PI

TIME SCURRIES ALONG, and I find that I have been a very bad correspondent. In August, 1945, I received a fine letter from A. T. Gurunather Brito, of "Wega," Ramanathan Avenue, Dahiwala, Ceylon, concerning a comment I had made about the notion of capitalizing the names of the Sun, Earth, and Moon. Mr. Brito's letter, in part, is as follows:

> I enclose a copy of the issue of **The Ceylon Observer** of 1945 August 17 reproducing at page 2 your clarion call in **Sky and Telescope** of 1944 October for a change in astronomical nomenclature. The other evening paper, **The Times** of Ceylon, of the same day carried a similar reference.
>
> It is surprising to have to learn that the evil has grown to such proportions that you have to cry for volunteers to join the revolution. I myself have been of the same view all along and was mightily pleased when your trenchant criticism appeared. I hope your appeal will not fall on deaf ears but will be broadcast throughout the popular press of every country.

This is certainly the moment for acknowledging agreement from several, including Dr. Alice Farnsworth and Dr. R. T. Crawford, the former of Mt. Holyoke College, the latter presently director of the Students' Observatory, University of California. Dr. Charles P. Olivier, of the Flower and Cook observatories of the University of Pennsylvania, also is very strong in his feeling that the words Sun, Moon, and Earth should be capitalized, when they refer to the specific astronomical bodies bearing those names. I have received not one communication (except from the editor of *Sky and Telescope*) expressing any preference for adherence to the dictionary practice of using lower-case initial letters for these names. My point is that the dictionary should not be permitted to dictate to astronomers what their nomenclature should be; we should tell the dictionary what we prefer and what we intend to do, and editors should be informed accordingly. I take this occasion to solicit further expressions of opinion in the matter. Maybe I've started something.

In the March, 1940, issue of The SKY, there was related in this department the story of Father Rigge, of Creighton University, who appeared in court to testify as to the time of taking a photograph offered in evidence. By means of the shadows in the picture he was able to determine the time with an error of only a few seconds. In the September, 1942, *Sky and Telescope,* the story of a similar experience I had was given.

Now we find in the Buffalo *Evening News* for Thursday, January 17, 1946, a story of a suit for damages because of an automobile accident that occurred on August 4, 1940. A traffic light in Amherst, N. Y., was not functioning because of a burned-out bulb, between 8:45 and 10:00 a.m. on that day. And at that light, during that interval, the accident occurred. Both drivers claimed the green light was showing, and it was suggested that the sun's light had produced the appearance.

Amateur astronomer George A. Davis, Jr., professionally an attorney, testified that between 8:45 and 10:00 a.m. on the date in question the altitude of the sun was between 38 and 50 degrees, and that the sun could not have produced the effect claimed, because of the metal visor shielding the traffic signal and preventing the sun when so high from shining on the signal lens. (I have determined from Mr. Davis' altitudes that daylight saving time was not in use on this occasion.)

The newspaper clipping does not give any information as to the orientation of the traffic signal, or whether or not the visor covered both signal lenses involved (presumably at right angles to each other) at the same time. Without seeing the particular traffic signal, or at least a photograph of it, we must assume our amateur astronomer took such factors into consideration in his statement, but if the lens were facing the sun when that body was at an altitude of only 38 degrees, the visor would need to be longer than any I have ever seen to prevent sunlight from entering the lens.

For an on-the-spot re-enactment of the accident, were the court to require further evidence, clear skies at Amherst on August 4th are the only requirement. To my mind, it is the best way to clinch it.

The question in the June issue about who sued whom over what referred to the general star catalogue compiled by C. A. Borst, with the assistance of his two sisters. Professor C. A. F. Peters suggested it to Borst, who worked on it out of regular hours, to complete it after about three years. Borst asked only that his name appear on the title page, and that Peters should be considered the editor of the catalogue. Peters refused, and sued Borst for the manuscript!

Peters was upheld in court, and by decision of Judge Williams of the Superior Court in 1889, the verdict was upheld. Peters was awarded interest on the value of the labor, from the date of Borst's refusal to surrender the manuscript! Simon Newcomb, in the *Utica Herald,* wrote a sarcastic letter, saying it would be a good way for an astronomer to make a living. The testimony of Asaph Hall and Benjamin Boss brought out that the cost of the work was not less than $12,000, although neither Peters nor Borst claimed that the manuscript had any commercial value.

In the spring of 1894, as recorded in *Astronomy and Astrophysics* for May of that year, the Court of Appeals handed down a decision reversing the verdict of Judge Williams, and ordered a new trial. I have never been able to find what happened next.

In May of this year, I gave Dolbear's formula for determining temperature from the rate of a cricket's chirping. Now I have at hand a letter from Professor W. R. Ransom, of the department of mathematics at Tufts College. "Amos Emerson Dolbear was professor of physics and astronomy at Tufts College from sometime in the '70's to about 1900. He was one of the inventors of the telephone, whom the Bell Company bought out, and he sent a message by wireless for a half mile or so while Marconi was still a child. He wrote 'The Art of Projection' and 'Matter, Ether and Motion.' I was a student under him in 1896-8 and heard him explain the 'cricket formula.' "

And now, let's dip far back into the files and recall that in December, 1942, I told that William Shanks, in 1873, computed the value of pi to 707 decimal places. Poor Shanks! That noise you have heard is Shanks, spinning in his grave. D. F. Ferguson, of the Royal Naval College, has discovered that Shanks made an error, at the 528th decimal! Can we ever again have confidence in anything?

R. K. M.

AMERICAN ASTRONOMICAL SOCIETY TO MEET AT MADISON

The 75th meeting of the American Astronomical Society will be held at the Washburn Observatory of the University of Wisconsin, Madison, Wis., from September 8th to 11th, on the invitation of Dr. Joel Stebbins, director of the observatory. Registration will begin at 4:00 p.m. CST, on Sunday, September 8th, with an opening gathering at the observatory residence that evening.

Two sessions for papers will be held on Monday, the 9th, and two more sessions the following day. The society dinner will be at 7:15 p.m. Tuesday. A session for papers on Wednesday morning, September 11th, will conclude the meeting. One of the sessions will be devoted to the teachers' conference.

The 76th meeting of the society will be held at Cambridge, Mass., this December, in conjunction with Section D of the A.A.A.S.

The great meteor of 1908 brought destruction to a vast area of Siberian forest. The meteorite has never been found.

The End of the World

By Robert R. Coles, *Hayden Planetarium*

THERE IS SOMETHING very final and conclusive about any theme that has to do with the end of the world. While most astronomers agree that such an event is probably a thing of the remote future, public interest, as judged by inquiries received at the Hayden Planetarium, is quite equal to that shown in such topics as life on other planets or the possibility of visiting the moon. And despite the lack of concern shown by scientists, hardly a year passes that someone does not make dire predictions in the press.

In September of 1945, a 72-year-old prophet in California told of a vision he had seen seven years before in which he was warned of the exact day, hour, and minute that the world would end! And when the appointed time arrived and nothing occurred he consoled his followers by setting a new date and urging them to wait in patience.

Ever since the announcement of the atomic bomb, a good many people have suffered mild attacks of the jitters in fear that experimenting scientists might accidentally set off a chain reaction which would result in the disintegration of the earth. In February this year a radio play, originating in Paris, dramatized just such a catastrophe and started a panic in France that was reminiscent of the famous Orson Welles Martian invasion broadcast of a few years ago.

In 1910, when astronomers announced that the tail of Halley's comet would sweep the earth, the papers printed the frightening predictions that certain poisonous gases might asphyxiate all life on our planet. Actually, the event produced hardly an appreciable indication that we were passing through the tail of the great comet.

While the astronomical facts concerning the end of the world may not be as sensational as some of the newspaper headlines, they are interesting nevertheless. In the first place, we must decide what the end of the world really implies. To some it means the complete destruction of the earth. Others might think of it as some tremendous earth-shaking catastrophe that would destroy all life, but leave the planet in such condition that complex, living organisms might again develop if the spark of life were to make its appearance. Or perhaps something might happen that would alter the environment so that all life would disappear but our planet itself might continue on its way, a barren world, unable to support even the least vestige of life.

There are other more-or-less sensational things that could happen to create havoc and destruction in a somewhat limited area.

Meteor Crater in Arizona and the scars left by the 1908 fall of meteoritic material in northern Siberia provide visual evidence of what can happen when such bodies land upon the earth. These catastrophes occurred in unpopulated regions with no known loss of human life, but it takes little imagination to picture what would happen if a large meteorite landed in a densely populated area such as Manhattan Island. While such an encounter would not mean the end of the world, the result would be quite the same for several hundred thousand inhabitants in the area concerned.

Thus it is possible to visualize the catastrophic consequences that would follow collision with a large meteor, the meteoritic material in the head of a comet, or even a small asteroid. However, the chances against such a body falling in one of our thickly populated areas are extremely great. It might not happen this year or for 10,000 years. But we must remember that in astronomical matters time is of little consequence. In one million or 10 million years the probability becomes somewhat greater.

Life on the earth and, indeed, the existence of the earth itself, is ultimately dependent on the future of a star. To say that our wagon is hitched to a star is something more than a picturesque figure of speech. That star, of course, is our sun. As an integral member of the solar system, the earth is held to the sun by the invisible force of gravity and accompanies our daytime star on its sojourns through interstellar space. From the sun we receive the life-supporting energy without which conditions on our planet would be very different from anything that most of us can imagine.

The speed of the earth's rotation, its period of revolution around the sun, the distance from the sun, and the degree at which its axis is inclined to the vertical are all factors that influence the physical conditions prevailing on our planet. A marked change in any of these would be immediately followed by environmental changes with a subsequent effect on life conditions. Too great a change in one of these factors and all life might disappear from the earth.

The sun is an average star very much like many other stars that we observe in the heavens. It has been radiating tremendous quantities of energy for untold millions of years. And in the light of the prevailing theory, which explains that this energy is being produced through subatomic forces reacting deep in the sun's interior, it appears that this radiation will probably continue for thousands of millions of years. But some day there will come an end to the supply of matter that can be thus converted into energy. And with the release of that final spark of energy the sun will become a cold, dead star — a ghost of its former self — plowing blindly through space. Then the earth will have turned into a frigid world, with its atmosphere frozen. Dark stars, that have spent nearly all of their energy, are known to exist. These may represent a picture of our sun in the dim and distant future. It must be admitted that this end of the world is a very long-range possibility. And while the world is waiting, some other fate may well befall our planet.

For instance, there might be a sudden and violent trend in the opposite direction. Not cold but heat might be the

nemesis of our earth. Every now and then we observe stars that for some yet unknown reason suddenly flare up to thousands of times their former brilliance. These are somewhat inappropriately called novae or new stars. It may be that something provides the trigger action and they explode like huge cosmic bombs. Then they gradually diminish in brilliance and return to their normal original brightness.

Since no one actually knows why certain stars behave in this violent fashion, we cannot be sure that such a catastrophe will not some day befall our sun. All evidence, geological and otherwise, points to the conclusion that the sun has been functioning as a very normal star for hundreds of millions of years. But no one can predict that it will continue that trend forever. A nova-like flareup of the sun might happen tomorrow or in 50 or 100 million years, and if it did the earth and its neighbor planets would almost immediately suffer the most terrible consequences.

More exciting, perhaps, than any of the possibilities so far considered, is the speculation that the destruction of the solar system might be achieved by the action of the same forces that may long ago have created it. Whether or not we accept the general hypothesis that the planets were drawn out of the sun by the gravitational pull of an unknown star that approached dangerously near or perhaps collided with the sun, it is possible that in the future such an encounter might occur and disrupt the solar system in one tremendous sweep.

While we must keep in mind the very great distances that separate the stars, it is also important to remember that they are all traveling and in various directions; some stars speed faster than the sun while others travel more slowly. With reference to the stars around us, our own sun is speeding along toward the constellation Hercules at about 12 miles per second.

If, during the millions of years in the future, the sun and another star were to approach within each other's spheres of gravitational influence, the resulting chaos would provide cosmic fireworks on a really spectacular scale. There might be a head-on collision or perhaps only a dangerously near approach. In either case the challenge to the imagination is equally interesting. Long before the stars came near enough for any physical effect to be noticed on the earth itself, a very gradual increase in brightness would occur, but it would take thousands of years before the star became as bright as Vega, Canopus, or Sirius. But with the passage of time each succeeding generation of astronomers would observe the approaching star with keener interest.

Then, as it steadily drew nearer to our corner of the universe, surpassing the brightest stars in magnitude, the first influence of its gravity would make itself felt. Perhaps there would be noticeable changes in the orbital speed of the earth, with a consequent change in the length of the year and the seasons. And at the same time the planets would be observed to act queerly; the outer planets, Pluto, Neptune, and Uranus, would perhaps be the first to feel the effect of the approaching star. From there on it is quite impossible to predict what might happen. In any event, if the star came close enough, there would be no escape for any living creatures then on earth. Even if we imagine this disaster approaching during that remote and questionable age of interplanetary transportation, escape to Venus or Mars would be of no avail since the entire solar system would be involved.

An outburst of the sun like that of Nova Persei 1901 would undoubtedly mean the end of all life on the earth.

The moon would seem to most people the least offensive of all celestial bodies and certainly the last place that one would look for trouble, but this satellite may some day play a dramatic part in the end of the world.

Figuring backward, astronomers calculate that the moon was once very much nearer to the earth than it is today, and the day and month were of different lengths than they are now. The earth's speed of rotation is decreasing principally as a result of the braking action of tidal friction in the oceans. This is a very gradual decrease, to be sure, amounting to only about one second in 100,000 years. But it is a cumulative effect and, again, time is of no consequence.

The energy lost by the slowing of the earth's rotation has been transferred to the moon's orbit, so our satellite has pulled away to a mean distance from the earth of about a quarter of a million miles. Now it requires about a month to complete its journey around the earth. And so, as the earth gradually slows down on its axis, our moon continues to recede. In the very dim and distant future it will be so remote that the month will be much longer than now. Due to its greater distance then, its tidal effect will be less pronounced and the earth's rotation period will no longer be retarded. Then an equilibrium of forces will be reached, after which there is a possibility that the moon will start approaching the earth.

Again the element of time, measured in billions upon billions of years, becomes the important ingredient. But given generous quantities of that ingredient, one suggestion is that the moon will come nearer and nearer to our planet until some day it will return to its present distance of a quarter of a million miles. But it will not stop there. Growing larger and larger with the lapse of centuries it will swing in still closer with ever-increasing tidal effects. (The oceans may have dried up by then; the tides will be in the body of the earth itself.) Before it ever could reach the earth, however, the moon would come within what is known as Roche's limit. At such a distance, the lunar orb would be unable to withstand the great difference in gravity on its opposite sides and it would be torn into millions of fragments that might encircle the earth like the rings that we see about Saturn.

But when and if our satellite ever does behave in this fashion, there would almost surely be no one on earth to observe it or expound on the similarity of our newly acquired ring to that of Saturn.

OPTICAL SOCIETY TO MEET IN NEW YORK

The 31st annual meeting of the Optical Society of America will be held at the Hotel Pennsylvania in New York City, October 3rd to 5th. The meeting is open to non-members of the society, and all interested persons are invited to attend.

STURGIS METEOR REPORT FALSE

A letter from Professor E. L. Tullis, of the South Dakota School of Mines and Technology, states that the report of a meteor falling at Sturgis is false. (See July *Sky and Telescope*, page 6.) Professor Tullis inspected the crater in Mr. Morrill's yard and found that it had resulted from the collapse of a gypsum cavern. He states that the crater is typical of the kind frequently thought to result from a meteorite.

PERKINS OPEN NIGHTS

A series of visitors' nights is being held at Perkins Observatory, Delaware, Ohio, during the summer and fall months. On August 8th and 9th, Thursday and Friday, Dr. N. T. Bobrovnikoff, director, will lecture on "The Moon," and observing will follow each lecture, weather permitting. Guest tickets are required, and may be obtained from the observatory.

Amateur Astronomers

David B. Pickering — Well-known Amateur

ON JUNE 13, 1946, the A.A.V.S.O. lost one of its most prominent and popular members with the passing of its patron and life member of over 30 years' standing, David B. Pickering. He died at his home in East Orange, N. J., after a lingering illness.

Pickering was closely associated with the society almost from its inception and, until very recent years, played an important part in its formation and later development. A man of dynamic personality and highly accomplished in many fields of endeavor, he has rendered valuable assistance to the A.A.V.S.O. Not only was he an expert variable star observer, but an able draftsman who was the one principally responsible for perfecting our chart system.

As a charming writer and fluent speaker, he did much to make the work of our association known to the scientific world as well as to the layman. Pickering was a member of the variable star commission of the International Astronomical Union, and he attended several meetings of the I.A.U. He was, for a number of years, a member of the Harvard College Observatory visiting committee. He sponsored the David B. Pickering Nova Medal, awarded several times for the visual discovery of novae. He, himself, received the fifth Merit Award of the A.A.V.S.O. in 1938.

Pickering was born in Elmira, N. Y., 73 years ago. His business success made him vice-president of Henry Blank and Company, manufacturing jewelers in Newark, N. J., a position he held until his retirement in 1926. He is survived by his wife and five sons, the eldest of whom, James, is taking up astronomy, both as an observer and as a writer.

David B. Pickering's travels to foreign countries, where he visited large and small observatories, did much to cement the feelings of good fellowship between amateur and professional astronomers. Accounts of these travels, written in his inimitable style in *Popular Astronomy* in the early '30's, stand as a lasting tribute to his versatility with the pen, and his outstanding personality as a friend to all.

In his later years he gave up active observing for painting, and proved to be an accomplished artist — his paintings have been exhibited on numerous occasions. Whatever Dave, as he was so familiarly known to many, put his hand to became a success. There are few of the "old guard" of the A.A.V.S.O. left to carry on, but spurred by the inspiration and devotion of men like Dave Pickering, it is certain that others will keep the association in the forefront of the scientific world.

David B. Pickering (1873-1946). Photo by William Henry.

Leon Campbell

Report from England

We are pleased to submit a report of the 1945-46 season of the Cambridge University Astronomical Society. Professor F. J. M. Stratton has kindly consented to become our president, with Dr. H. A. Brueck as vice-president. Membership is now over 120, and the society has had nine lectures during the year. Visiting speakers have included Professor H. H. Plaskett, Dr. C. R. Birch, Monsieur B. Lyot, and J. P. M. Prentice.

Members have also been able to make some observations of celestial objects at the University Observatory during the winter terms.

Joan Cushen, secretary

Pennsylvania Group

The Amateur Astronomers of Beaver County have elected new officers as follows: R. Thomas Lu Caric, of Baden, president; Mrs. Roelof Weertman, Beaver, Pa., vice-president; William Lintz, Beaver, program chairman; Mrs. R. Thomas Lu Caric, secretary and treasurer.

The group will resume meetings for the 1946-47 season on September 10th, at the home of Oscar Campbell, Beaver, Pa.

Mrs. R. Thomas Lu Caric, secretary

THIS MONTH'S MEETINGS

While many amateur groups do not schedule regular meetings for the summer months, they may have unscheduled observation parties or informal get-togethers, at which any visiting amateurs would be welcome. Traveling amateur astronomers may refer to Here and There with Amateurs, which appeared in the June issue of *Sky and Telescope*, for information as to whom to contact in any of the 51 cities listed.

Chicago: The Burnham Astronomical Society will hold a barbecue and observation party on Saturday night, August 3rd, at the country home of Mr. and Mrs. Homer C. Torreyson, Prospect Heights, Mt. Prospect, Ill. All members having telescopes are asked to bring them. On previous such occasions, from 20 to 25 telescopes have been assembled for the use of members and their friends.

Geneva, Ill.: On Sunday, August 11th, at about 10 p.m., the Fox Valley Astronomical Society will meet for Perseid meteor observing, at a place to be announced. Information may be had from William Siekman, Woodlawn Ave., Batavia, Ill.

Indianapolis: At the meeting of the Indiana Astronomical Society on August 4th, there will be outdoor observations, and a talk by Herbert M. Wood on "Color in the Stars." Information may be had from E. W. Johnson, 808 Peoples Bank Building.

New York: The Amateur Astronomers Association will hold its annual Labor Day weekend field trip at the Blue Mountain Trail Lodge, Peekskill, N. Y., on August 30-September 2. The program will include astronomical activities by day and night, and various sports. Overnight facilities are available only to a limited number of A.A.A. members.

Cincinnati Astronomical Society and Its Equipment

The Cincinnati Astronomical Society holds monthly meetings on the second Wednesday at the home of the president, John Cartlidge, at 5556 Race View Ave., Cincinnati. The group was founded in 1910 by the late Dr. De Lisle Stewart, who was an observer at Harvard's southern station when it was located in Peru.

Equipment available to the society includes an 8-inch Clark refractor, and 3-inch and 4-inch Bardou refractors. The group owns a 28-inch reflector which is polished but as yet unmounted, and 143 acres of the best astronomical site in the locality.

Inquiries about the society and its activities are welcome.

Alfred H. Hasemeier, secretary
2945 Ravogli Ave.
Cincinnati 11, Ohio

NEWS NOTES

By Dorrit Hoffleit

CHARLES FABRY

An eminent physicist and astrophysicist, known especially for his work with the Fabry-Perot interferometer, died in Paris last December at the age of 78. Charles Fabry's contributions to astrophysics included measurements of solar wave lengths, photometric measures of the sun, its corona, the night sky, solar ultraviolet spectroscopy, and the effect of the ozone layer in atmospheric absorption. For 40 years he served on the committee on standard wave lengths of the International Astronomical Union (and its predecessor, the International Union for Solar Research), and was a member of committees on nebulae, photometry, and spectrophotometry.

METEOR SHOWER? MAYBE!

On the night of October 9th in 1933, a very spectacular display of meteors was seen in Europe, with a rate as high as 400 a minute being observed. This display was of such short duration, however, that it was practically over before the United States had been rotated to face the proper direction. The meteors were debris of Comet Giacobini-Zinner, discovered in 1900 by Giacobini and rediscovered in 1913 by Zinner. It has a period of about 6½ years, and on May 29th this year was observed as an object of the 17th magnitude by Dr. H. M. Jeffers, of Lick Observatory.

The return of the comet and the possibility of an even more spectacular shower is well discussed in the 1946 *Handbook* of the British Astronomical Association, where it is pointed out that in 1933 the comet preceded the earth at the nearest point in its orbit (then 500,000 miles) by 80 days, whereas this year the comet will precede by only eight days and the position of nearest approach to the orbit is reduced to about 135,000 miles. A 15-day-old moon is the only unfavorable factor.

Dr. L. E. Cunningham, of Berkeley, Cal., has revised the comet's original elements by Cripps on the basis of Dr. Jeffers' position, and writes to Harvard:

"The earth will cross the orbital plane of Comet Giacobini-Zinner on 1946 October 10, at $3^h.0$ universal time, at a distance of 132,000 miles from the orbit, but will be 1,000 miles closer half an hour earlier. It will remain within 500,000 miles of the orbit, which was approximately the distance during the meteor shower of 1933, from October 9th at $12^h.5$ to October 10th at $16^h.5$, some 28 hours. Observations of the comet during the next three months may alter these figures slightly."

The B.A.A. *Handbook* gives the shower radiant as at right ascension 262°, declination 54° north, in the head of Draco. This radiant will be high early on the evening of October 9th, and meteors are expected to be most profuse before midnight, except for interference by the moonlight, already mentioned.

The comet itself is becoming a fair object for telescopic observation. On the basis of work by Dr. G. Van Biesbroeck, of Yerkes Observatory, Dr. Cunningham has computed its probable brightness at the following positions:

Date	h	m	°	′	Mag.
July 31.0	20	52.0	+66	02	11.4
Aug. 8.0	21	19.3	+71	09	10.8
16.0	22	19.5	+76	20	10.2
24.0	0	50.3	+79	42	9.6
Sept. 1.0	4	06.3	+75	14	9.0
9.0	5	37.9	+62	14	8.5
17.0	6	18.4	+43	28	8.2
25.0	6	41.0	+22	35	8.2
Oct. 3.0	6	55.2	+ 4	14	8.6
11.0	7	04.9	− 9	35	9.2
19.0	7	10.7	−19	30	9.8
27.0	7	13.1	−26	40	10.5
Nov. 4.0	7	12.0	−31	55	11.1
12.0	7	07.5	−35	44	11.7

As this comet shows occasional variations of two or three magnitudes, the magnitude predictions given above are to be taken with considerable reservation.

V-2 ROCKETS TO RECORD SUN'S ULTRAVIOLET RAYS

Films developed by Eastman Kodak Company with special fluorescent coatings will be used in spectrographs mounted in the noses of V-2 rockets. Ultraviolet sunlight, unable to penetrate either our atmosphere or ordinary photographic emulsions, will be recorded when the rockets reach altitudes of about 100 miles. The fluorescent film coating glows when ultraviolet light strikes it, and the glow is recorded on the film.

METEORS, BURNING PLANES AND ROCKETS

Under this title in *Popular Astronomy*, H. H. Nininger, of the American Meteorite Laboratory, pleads for the teaching of meteoritics in high schools as well as in colleges. Bright meteors are ordinarily seen only by casual, uninformed observers, and the general public is absolutely unprepared to assist in gathering and reporting the facts.

"The foreseeable future of aeronautics is going to multiply the difficulty manyfold," writes Dr. Nininger. Confusion arises from the resemblance between burning airplanes and distant fireballs. Meteors reported as burning planes result in waste of time, effort, and even concern the safety of search crews. Knowledge of relative distances ascertained roughly from observers at different places would eliminate false conclusions of this nature. The prospect of high-speed stratospheric planes and rockets streaking across the sky makes distinguishing the various classes of objects increasingly important, especially to the meteoriticist, ever in need of more data.

HENRY DRAPER MEDAL

The Henry Draper medal of the National Academy of Sciences has been awarded to Dr. Paul W. Merrill, of Mount Wilson Observatory, for his contributions in stellar spectroscopy. In recent years he has done significant work on *B*-type stars whose spectra show emission lines.

SOUTH AFRICAN ASTRONOMER DIES

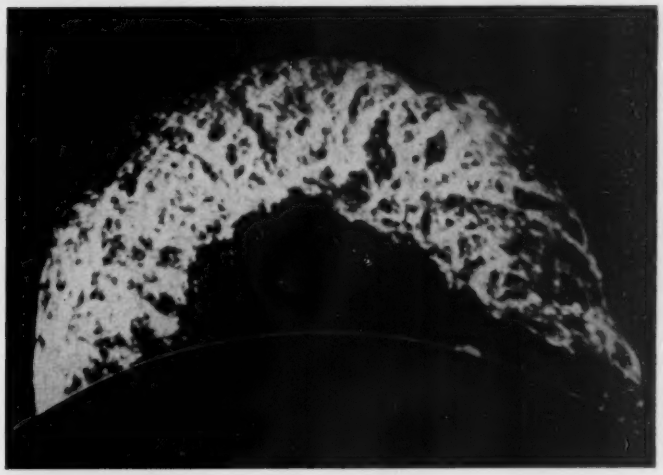
In the *Monthly Notices* of the Astronomical Society of South Africa, we learn of the death of H. E. Wood, of the Union Observatory. The account is written by Dr. W. H. van den Bos, who succeeded Dr. Wood as director of the observatory after his retirement five years ago.

When Dr. Wood first went to South Africa, it was to a meteorological post under Sir David Gill, who also acquired the services in the South of his librarian, R. T. A. Innes, an ardent astronomer. As a consequence of the efforts and enthusiasm of these two, the Union Observatory had already introduced astronomy into its program by 1907, and by 1910 Wood, too, had become an astronomer, working on the now famous Franklin-Adams star charts. In time, the observatory became purely astronomical, and the meteorological office was separated from it.

COMET BROOKS

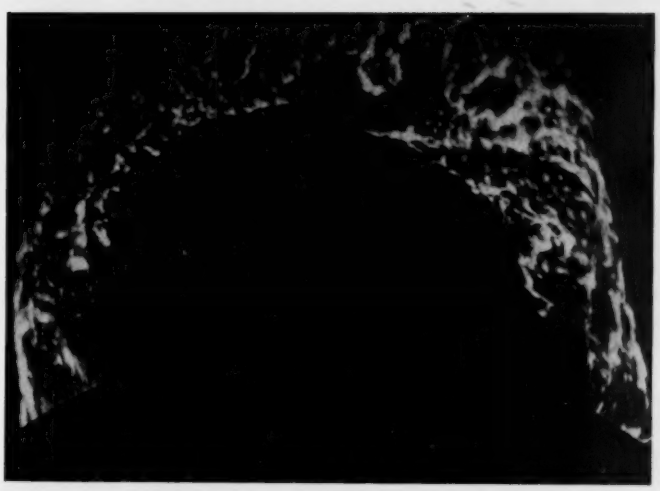
Comet Brooks was first discovered telescopically by W. R. Brooks in 1889. It has a period of about seven years and has been observed at nearly every return since its discovery. On June 29th of this year it was found by Dr. H. M. Jeffers, at Lick Observatory. It was of the 18th magnitude, but is expected to become apparently brighter after perihelion passage on August 25th, when it will come within about 91,600,000 miles of the earth. Comet Brooks is not expected to reach naked-eye visibility.

According to Chandler and Poor, this comet passed within 55,000 miles of the surface of Jupiter in 1886. Before that close encounter, the comet's period had been 29 years and its perihelion distance 5.5 astronomical units, almost as great as the aphelion distance is now. In the year of its first discovery, Barnard had noticed Brooks' comet to be accompanied by four faint companions, the probable wreckage of the close encounter with Jupiter.



Eruptive Arch Prominence

The largest ever photographed at Harvard's Climax station.



This remarkable series of photographs, taken on June 4, 1946, by Dr. Walter O. Roberts with the coronagraph at Climax, records a very unusual arch prominence which expanded at amazing speed. The front cover of this issue is an enlargement of the second picture (upper right).

An idea of the rapid changes in this prominence can be gained from the following times for these five frames, all Greenwich civil time on June 4th: 16:03, 16:36, 16:51, 17:03, 17:23.

To obtain the scale of these pictures, draw a circle to complete one of the segments of the sun's disk, taking its diameter as roughly 864,000 miles. The scale thus obtained is about 144,000 miles to the inch. The height of the prominence in the second frame (cover picture) is over 200,000 miles.

CONCERNING THE SUN

WHILE THE SUN itself is putting on demonstrations such as the prominence pictured above, astronomers, meteorologists, and radio technicians are seeking to solve the mysteries of the influence of the sun on many terrestrial affairs.

Solar study is a field in which international co-operation has long been practiced, and problems of modern radio communication make this a greater necessity than ever before. The current visit of the famous French astronomer, Dr. Bernard Lyot, to this country is therefore of great significance.

With M. P. Lacroute, director of the observatory at Strasbourg, and M. Desroches, an engineer in the Messier optical works, Dr. Lyot is now touring American observatories. His visit began on July 10th, at Harvard College Observatory, where scientists from the National Bureau of Standards, Massachusetts Institute of Technology, and Harvard gathered to discuss with Dr. Lyot the current status of solar, ionospheric, and meteorological studies.

Dr. Lyot, who is the inventor of the coronagraph, is showing his latest motion pictures of the solar corona and prominences. He also has equipment for testing seeing conditions at each American observatory he visits.

THE IND

JOHN FLAMSTEED, one of the greatest pioneers of practical astronomy, was born three centuries ago, on August 19, 1646, at Denby, Derbyshire.

His mother died when he was three years of age, and his father must have often despaired of John's success, for through illness the boy was seldom able to attend school. But young Flamsteed was no ordinary lad. Although he did not begin serious study of arithmetic until 16 years of age, he read voluminously of both contemporary and classical literature. While still at school, he began the astronomical observations which were to decide his future career. His first observing instrument was a home-made quadrant. He had set out for the stars, which neither the annoyance of those who scoffed at him nor the state of his health could stop him from reaching.

In his 19th year, Flamsteed drew up a catalogue of 70 stars, supplementing this with an investigation of the partial solar eclipse of 1666. Three years later he began to study the movements of Mars and Jupiter among the stars, his measurements revealing the planetary tables to be at fault.

At length he sent a paper on occultations to the president of the Royal Society, so making his entrance into the sphere of professional science. But desiring to meet other scientists on a common academic footing, he became a student at Cambridge University, where he graduated in 1674. (According to Maunder, he planned to enter the church; he was ordained later, almost at the time of his becoming first Astronomer Royal, and had a clergyship at Burstow, to which he often journeyed from Greenwich.)

The first Astronomer Royal, John Flamsteed, as he appears on the frontispiece of "Historia Coelestis." Reproduced from an original edition in the library of Harvard College Observatory.

Soon afterwards Flamsteed was nominated a member of a committee appointed to consider the claim of a Frenchman, Le Sieur de St. Pierre, to a reward offered by the English government for a method of calculating longitude from celestial observations. The method placed before the committee was based upon a comparison of the observed altitudes of the moon and the stars. Flamsteed was asked to provide the observations needed to illustrate the scheme's practicability. These he soon supplied, but he pointed out their doubtful utility in the Frenchman's method, which relied on the use of charted moon and star positions, many of which Flamsteed's observations had proven to be incorrect.

As a result of the matter, the king was petitioned on the need for the erection of an observatory where the celestial bodies could be studied and accurately charted to aid the finding of longitude at sea. King Charles II was far from being selfish or unwise on this occasion and readily decreed that the project should be carried into effect as soon as possible.

Flamsteed was appointed "Astronomical Observator" at a salary of £100 a year, his duties being "forthwith to apply himself with the most exact care and diligence to the rectifying the tables of the motions of the heavens, and the places of the fixed stars, so as to find out the so-much-desired longitude of places for the perfecting the art of navigation."

The plan of the observatory was drawn by Sir Christopher Wren, who chose Greenwich Hill as the most suitable site for its erection. Costs were met by a royal grant of £500, which the king supplemented by providing bricks from Tilbury Fort, and wood and metal from a demolished gatehouse in the Tower. The foundation stone was laid on August 10, 1675, and the Royal Observatory of Greenwich was completed within the following year.

By the end of October, 1676, Flamsteed had taken up residence there and commenced his duties as first Astronomer Royal of England. Despite the king's promise of further assistance, Flamsteed was left to equip the observatory himself, out of a paltry salary made even paltrier by a £10 tax.

The instruments with which he set out on his great venture made a humble array. They were an iron sextant, a quadrant, two telescopes, and two clocks given to him by a friend. The clocks, it is interesting to note, he regulated by the observed altitudes of the stars, basically the method which is used today.

Flamsteed's initial observations were made on similar lines to those of earlier astronomers, and consisted of measuring the distances of the stars relative to one another, and determining by calculation their positions in relation to celestial reference lines.

The sextant he used in these observations was furnished with a slow-motion vernier which expressed the angles measured as so many revolutions or parts of a revolution of the screw. Finding the device insufficiently accurate for delicate measurements, he contrived a special scale of his own which enabled him to determine the positions of the stars with far greater precision than that obtained by earlier astronomers.

To ascertain the latitude of the observatory he found it necessary to obtain a mural quadrant. Thanks again to the friend who had given him the clocks, he was supplied with the necessary instrument. This, however, was too large to be manageable, so that Flamsteed had to resort again to the sextant. By its means, though it was unsuited to the task, he succeeded, in 1677, in determining the latitude of the observatory with high accuracy.

Eventually it became necessary to measure the altitudes of stars with a mural arc. This instrument the government refused to supply, so that Flamsteed had to construct one at his own expense. By its means, despite warping due to its weak construction, he succeeded in obtaining the necessary measurements and compiling a catalogue of 130 stars, vital as points of reference for future

DIAMOND JUBILEE OF CORDOBA OBSERVATORY

Scientists in North America have received invitations from Cordoba Observatory and the Argentine Physical Society to attend a scientific meeting at Cordoba on September 20-23, 1946. The meeting will commemorate the 75th anniversary of the founding of the observatory.

JOHN A. MILLER DIES

On Saturday night, June 15, 1946, Dr. John A. Miller passed quietly away at his home in Wallingford, Pa. He had reached the age of 86.

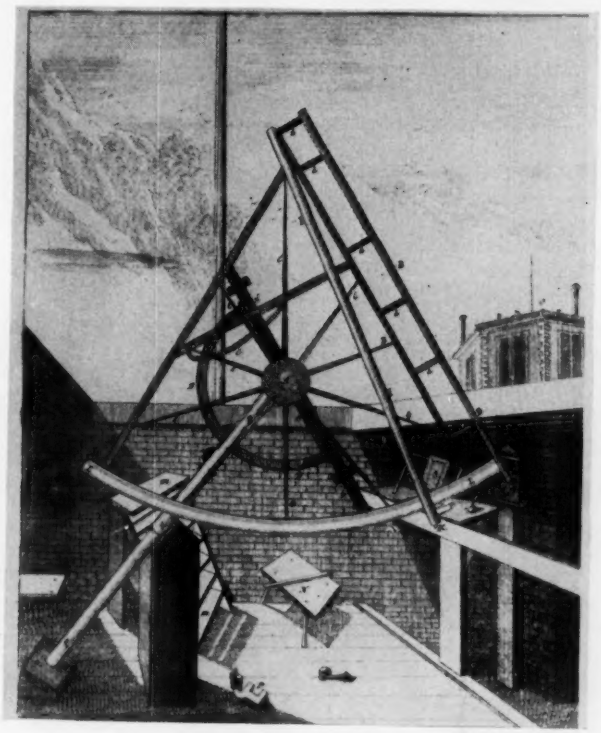
For the past 40 years, Dr. Miller had been connected with Swarthmore College, from 1906 to 1929 as professor of mathematics and astronomy; from 1914 to 1929 he was also vice-president of the college. For the next seven years he was director of Sproul Observatory and research professor of astronomy, and after 1936 he served as director of the observatory and professor of astronomy, emeritus. (See The SKY, March, 1941, for an article about Dr. Miller and some of his astronomical work.)

IDOMITABLE MR. FLAMSTEED

By N. A. Mackenzie, *Astronomical Society of Edinburgh*

observations of positions of more stars.

Through the death of his father, in 1688, Flamsteed acquired a little money, and was thus able to construct a stronger mural arc. Designed by Abraham Sharp, an assistant paid by Flamsteed, the instrument took over a year to make, costing £120. Although a masterpiece of mechanical precision, the arc had to undergo rigorous tests lasting another year before it could be used for astronomical observations. Those undertaken by its aid enabled Flamsteed to achieve his most brilliant work and to commence the formation of a greater and more accurate star chart than had ever been possible before.



Flamsteed's sextant, as it was housed in the observatory at Greenwich. Reproduced from "Historia Coelestis."

In spite of having to tutor students for a living, Flamsteed toiled resolutely on, observing and calculating the positions of more and more stars for his great catalogue and preparing tables of the observed places of the moon and planets. It was his aim, when these results had been fully accomplished, to publish them in a form of practical use to navigation. Of his determination to see his mission thus completed, by his own unaided efforts if necessary, he wrote as follows to a colleague:

"I am ready to put the observations into the press, as soon as they that are concerned shall afford me assistants to copy them and finish the calculations. But if none be afforded, both they and I must sit down contented, till I can finish them with such hands as I have; when I doubt not but to publish them, as they ought to be, handsomely and in good order, and to satisfy the world, whilst I have been barbarously traduced by base and silly people, that I have spent my time much better than I should have done if, to satisfy them, I had published anything sooner or imperfect."

Meanwhile, other scientists (Newton and Halley among them) were growing impatient for a report on his researches, so that Flamsteed was induced to draw up an estimate of the extent and plan of presentation of his proposed work. The estimate received official approval, but the expense of publication, as usual, was left to come out of someone else's purse.

Prince George of Denmark, the queen's consort, generously undertook to defray the costs. Accordingly, on the recommendation of a committee of scientists appointed to inspect the manuscripts, Flamsteed entrusted to their care a copy of his observations, together with a catalogue of stars deduced from them. The catalogue being incomplete, he only deposited it with the committee as a guarantee for the future delivery of a more perfect copy for publication. Printing of the observations was begun in 1706, but was interrupted two years later by the death of Prince George of Denmark. In 1711, the work was resumed by order of the queen and published in the following year under the title of *Historia Coelestis*.

Due to inefficiency on the part of the publishers, who had acted without Flamsteed's consent, the book presented only an incomplete account of his observations, and the imperfect star catalogue which he had originally deposited with the committee on the strict understanding that it was not to be published. To make matters worse, the preface was written by an astronomer who held a personal grudge against Flamsteed, and who allowed this to affect his opinion of his colleague's work.

These circumstances decided Flamsteed to publish a complete edition of his observations at his own expense. He had barely completed the second of his planned three volumes when, the magnitude of the task proving too much for his aged, pain-racked body, he died, on December 31, 1719.

The third volume, including his atlas of 3,000 stars, was completed by the voluntary labors of Sharp and Joseph Crosthwait, Flamsteed's faithful assistants. How loyal they were is shown by the following passage of a letter from Crosthwait to Sharp:

"I can assure you, with the greatest sincerity, that I shall for ever (though I am sure I shall have no share in the profits) retain a grateful remembrance of the generous and kind assistance you have given towards completing Mr. Flamsteed's works, and I shall be ready at all times hereafter, so long as life endures, when in my power, to return you gratitude; and the memory of the ingenuous and disinterested Mr. Sharp will always, by me, be had in the greatest esteem, next to that of my deceased and good friend Mr. Flamsteed."

PERSEID METEORS

August is the best month for meteors, mainly because of the Perseid shower. The full moon near maximum will interfere with observations of the faint meteors, but the Perseids are notable for bright, fast meteors, so observations are worthwhile during maximum as well as before and after (see note last month). The radiant at the night of maximum, August 11-12th, is at $3^h\ 0^m$, $+57°$. E. O.

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BOOKS AND THE SKY

THE COMING AGE OF ROCKET POWER

G. Edward Pendray. Harper and Brothers, New York, 1945. 244 pages. $3.50.

MR. PENDRAY, long himself an experimenter with rockets, has written an interesting summary of the development of rockets, and makes sane evaluations of their possible use for extra-terrestrial probing.

Experimentation with jet propulsion began centuries ago in a crude form. Within our century, the development of new fuels and new steels capable of withstanding high temperatures has made jet propulsion practical. It cannot be overlooked that the military possibilities of rockets brought governmental backing to the former personally financed experimentation in this novel field.

The author of this book was one of those early members of the American Rocket Society who more than a dozen years ago devoted much spare time to experimenting with liquid-fuel rockets, a type which had been first constructed in 1926 by the famous Robert H. Goddard. This is the same type of rocket used in V-2 bombs today. In 1934, the society's Rocket No. 4 was fired at Marine Park, Staten Island, and was one of the first liquid-fuel rockets to reach the speed of sound.

Astronomers should take considerable interest in rocketry, for serious thought is being given to the problem of controlling and guiding projectiles in interplanetary space. Problems in celestial mechanics arise when the best trajectories for hitting the moon are considered, while three-dimensional navigation is a new field in itself.

Mr. Pendray is cautious in approaching the subject and points out that with fuels known late in 1944, it was probably impossible to accelerate a rocket sufficiently to break it loose from the earth's gravitational field. However, the vast new source of atomic power had not then been revealed, so its implications could not be considered. With the ingenuity that has marked rocket development, it seems improbable that atomic energy will not be utilized within the next 10 years to overcome the difficulties of fuel consumption.

In 1919, Dr. Goddard proposed that a rocket shot toward the moon should be filled with flash powder so that an observable reaction would occur upon contact. It may now be suggested that an atomic warhead be used, but if the moon is missed, just be sure the earth does not go wandering into that part of space.

FLETCHER G. WATSON
Harvard University

NEW BOOKS RECEIVED

GERMAN FOR THE SCIENTIST, *Peter F. Wiener*, 1946, *Chemical*. 238 pages. $3.50.

A handbook designed particularly for students in physics and chemistry who wish to acquire as rapidly as possible a reading knowledge of scientific German.

AN INTRODUCTION TO THE STUDY OF ECLIPSING VARIABLES, *Zdenek Kopal*, 1946, *Harvard University Press*. 220 pages. $4.00.

An exhaustive and technical treatment of an ever-expanding phase of modern astronomy, published as Harvard Observatory Monograph No. 6.

THE STAR ATLAS AND NAVIGATION ENCYCLOPEDIA, *S. S. Rabl*, 1946, *Cornell Maritime Press*. 161 pages. $5.00.

The yachtsman or amateur astronomer will find many of the principles and problems of navigation in this book, which is in 8½ x 11 size, and profusely illustrated with diagrams and star charts.

DAVID RITTENHOUSE, *J. Edward Ford*, 1946, *University of Pennsylvania Press*. 226 pages. $2.50.

A new volume in the Pennsylvania Lives series, which has already included a biography of John Brashear, is devoted to the 18th-century astronomer and patriot whose name figures so largely in astronomical and civic affairs of the colonial period.

SUN, MOON AND STARS, *Skilling and Richardson*, 1946, *Whittlesey House*. 274 pages. $2.50.

Subtitled "Astronomy for Beginners," this book is designed particularly to appeal to the teen-age reader and to adults who want an elementary presentation. It discusses the solar system and things beyond, and includes a section on astronomers and observatories.

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THE BOOK CORNER

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In Focus

WITH THIS back cover in the current series of moon pictures, we reach again the northern limb of the moon. All the named features in the region pictured are identified on the accompanying chart. Spellings follow the International Astronomical Union's **Named Lunar Formations**, by Blagg and Mueller, and bibliographical information is from the British Astronomical Association publication, **Who's Who in the Moon.** Reference may be made to preceding charts and to In Focus items for information about some of the features this month.

Alpine Valley. The formation is about 75 miles long and five miles wide, one of the moon's most remarkable features.

Alps. This range of mountains runs in a curved line from Cassini to Plato. Only about half of its extent shows at this phase. The range was named by Hevelius. The promontories **Agassiz** and **Deville** were named for the Swiss naturalist of the 19th century, and a French geologist who made field studies of volcanoes and earthquake phenomena during the middle 1800's.

Archytas. A ring plain about 25 miles across on the edge of Mare Frigoris. It was named for an early Greek philosopher and geometer, friend of Plato, who is said to have constructed machines and automatons, including a wooden dove that would fly.

Aristoteles. A conspicuous ring plain, with a number of interesting ridges extending outward from its walls, and huge walls that rise about 11,000 feet above the interior of the formation.

Arnold. This was named by Schroeter for a German amateur astronomer (1650-1695) who discovered the comet of 1682, and observed and recorded the 1690 transit of Mercury. On the moon, Arnold is a ring plain about 50 miles in diameter, with broken walls. Its appearance is very similar to a number of other features near the northern limb and close to the lunar north pole, according to Goodacre.

W. C. Bond. Named for William Cranch Bond (1789-1859), first director of Harvard College Observatory, whose son, George Philip Bond, succeeded him as director and is also represented on the moon. The formation is a good-sized irregular plain.

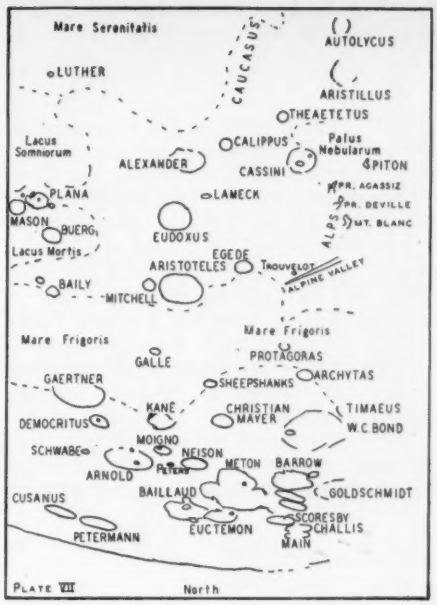
Egede. A ring plain with walls only about 400 feet high. It was named for a Danish missionary of the 17th and 18th centuries.

Eudoxus. This formation, though smaller, is of much the same character as Aristoteles. Eudoxus (c. 408-355 B.C.) was a Greek astronomer who studied under Plato, and whose book on the constellations, as transmitted to us by Aratus, is the earliest known description of the ancient constellations.

Gaertner. A ring plain with its walls evidently partly eroded away, named by Schroeter for a German mineralogist and geologist.

Mare Frigoris. A portion of this lunar sea already appeared on Plate III in this series.

Meton. This Greek astronomer was originator of the Metonic cycle, in which 235 lunar months nearly equal 19 solar years.



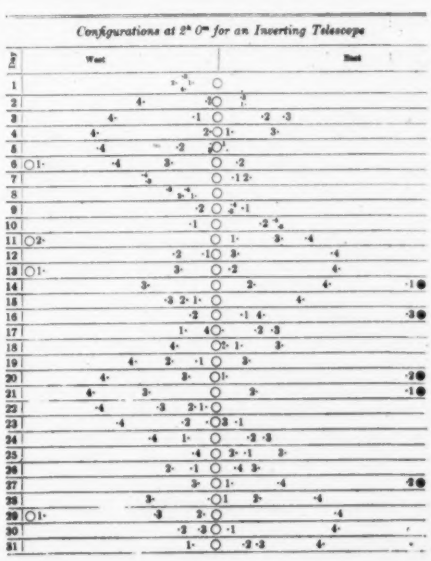
Mt. Blanc. Appropriately situated in the Alps, this mountain was named by Schroeter, is very massive, and is believed to be about 14,000 feet high.

Neison. The formation is named after a famous student of the moon, formerly director of Natal Observatory, and author of **The Moon**, published in 1876, with a two-foot map and drawings of special lunar areas.

Sheepshanks. Anne Sheepshanks was sister of Richard Sheepshanks, in whose memory she endowed an exhibit at Cambridge University, and made generous donations for the advancement of astronomy and allied sciences. She also gave a new transit instrument to Cambridge Observatory. She lived from 1789 to 1876.

JUPITER'S SATELLITES

Jupiter's four bright moons have the positions shown below for the GCT given. The motion of each satellite is from the dot to the number designating it. Transits of satellites over Jupiter's disk are shown by open circles at the left, and eclipses and occultations by black disks at the right. Reproduced from the American Ephemeris and Nautical Almanac.



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August: THE END OF THE WORLD. Our world will inevitably end — someday — probably billions of years from now. Here is the dramatic story of the several ways it could happen.

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STAFF: *Honorary Curator,* Clyde Fisher. *Chairman and Curator,* Gordon A. Atwater. *Other lecturers:* Robert R. Coles, Catharine E. Barry, Shirley I. Gale, Edward H. Preston.

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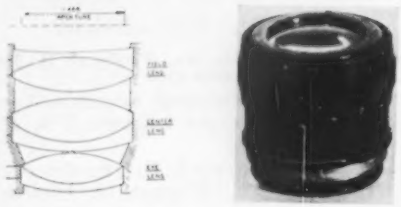

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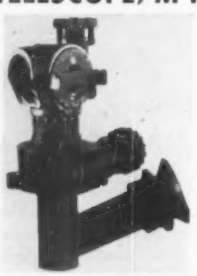

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The geometry of the arrangement was explained in The SKY, June, 1941, where the accompanying Fig. 1 was reproduced, indicating that the principle of the Cassegrainian is that of a hyperboloidal secondary mirror operating in conjunction with the usual paraboloidal primary. The secondary is convex, and is placed inside the principal focus of the primary, so as to form a new principal focus for the instrument at a selected distance behind the primary mirror, which is pierced with a central hole.

The principal focus of the primary mirror and the final focus of the telescope are the two foci of the hyperbolic figure of which the secondary mirror is a part.

Computations. The equivalent focal length of the combination is defined as the focal length of a thin lens or single mirror which would give the same magnification as the combination. This is represented in Fig. 2 by the mirror shown in dotted lines at the extreme right, produced by extending the rays backward from the final focus to their intersection with the entering rays. The equivalent focal length (e.f.l.) is given by:

$$F' = \frac{F_1 F_2}{F_2 + F_1 - d}, \qquad (1)$$

where F_2 is to be taken negative; F_2 is the focal length of the secondary mirror (one half the vertex radius of curvature).

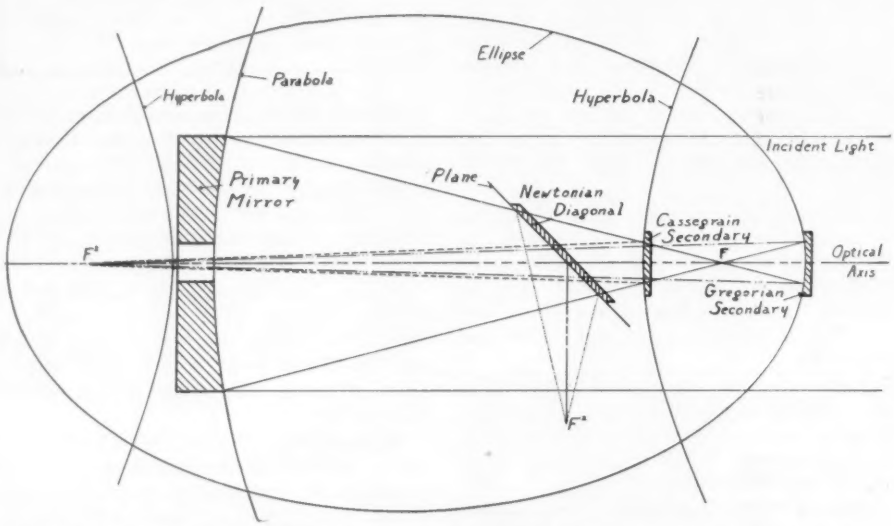

Fig. 1. The three principal types of reflecting telescopes are here illustrated together. F^1 is the Cassegrainian focus.

The ratio F'/F_1 is known as the amplification.

Usually, the aperture **A**, the equivalent focal length **F′**, and the distance, **p**, of the final focus behind the primary mirror, are known, and the rest of the data must

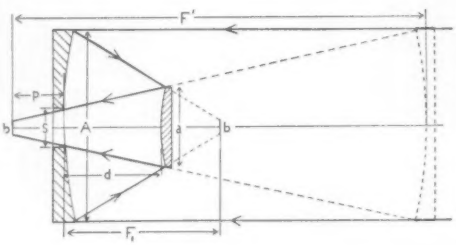

Fig. 2. Equivalent focal length.

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be computed. The greater the amplification, the steeper will be the curves on primary and secondary (disadvantageous), and the smaller will be the diameter of the secondary and the length of the tube (advantageous). A compromise must be struck between these two factors. This is most easily done by adopting a value for the focal ratio of the primary mirror which is reasonably small and yet which can be produced without undue difficulty in figuring and testing. Probably a reasonable figure is f/3 to f/4, although an experienced mirror maker who does not object to the troublesome task of figuring a short-focus mirror may wish to make his primary of f/2.5 or thereabouts.

We can, therefore, assume that we know the quantities F', F_1, p, A, in Fig. 2, and proceed to a determination of the remaining values. Intersection of the two cones gives values for d and a as follows:

$$d = \frac{F_1 (F' - p)}{F_1 + F'}, \qquad (2)$$

$$a = \frac{(d+p)(A-b)}{F'} + b. \qquad (3)$$

The quantity b in equation (3) is the diameter of the field lens of the largest eyepiece to be employed, or the diameter of the plate if the telescope is to be used photographically.

The focal length of the secondary is given by a transposition of equation (1):

$$F_2 = \frac{F' (F_1 - d)}{F_1 - F'}. \qquad (4)$$

Construction. The primary mirror, of course, is constructed in the usual manner. The shortness of its focal length may make it difficult to test; in the ordinary Foucault test, the pinhole or slit and the knife-edge must be very close together. It is better to test it with a flat, in the event that one is available.

Fig. 3. Testing the secondary.

The secondary is best tested in conjunction with the primary, preferably in the actual tube in which it is to be used. This means that the primary must be finished first. If convenient, it should be silvered or aluminized before testing the secondary. The test will be at the primary focus, and a source of parallel light is necessary. Another parabolic mirror makes a suitable source, and the setup is shown in Fig. 3. The position of the source slit is determined by locating a star image in the object mirror. As shown in the figure, the knife-edge is located at the final focus and the shadows indicating a perfect mirror are, of course, flat.

Figuring the secondary for a perfectly flat shadow picture is somewhat more accurate than figuring for parabolic shadows, since the element of judgment does not enter to the same extent. Small imperfections in the figure of the primary mirror (that is, overcorrection or undercorrection) may be compensated in the secondary. Any degree of imperfection left in the primary, however, should be very small.

Perforation. The hole in the primary is best bored with a brass tube in a slow-speed drill press. In the absence of a drill press, a jig can be constructed and the job done with a hand brace (Fig. 4). The brass disk has its edges serrated as shown in the diagram, and carborundum is fed to it during the boring process. There are several schools of thought as to just when the boring should be done. The mirror should be ground and polished before boring, but whether or not it

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should be completely figured before the central hole is bored is a matter of opinion.

In any event, the hole cannot be left open during the figuring process, as a badly turned edge near the hole may result; also, the edges may scrape the lap. Some amateurs bore out the center hole before figuring, and then replace the plug, holding it in place with wax or cement during figuring. Others prefer to leave the boring until the mirror is completely figured. In this case, however, the boring may relieve strains in the glass and give a turned edge anyway.

The boring is done first from the back, to within a small fraction of an inch from the front surface, then the mirror is turned over and the additional boring done from the front. This avoids chipping the edge

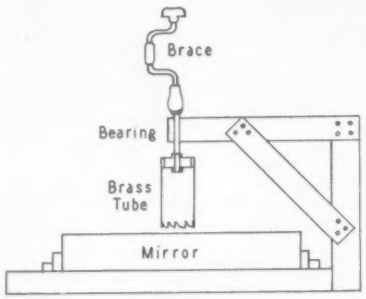

Fig. 4. Perforating the mirror.

of the hole. Of course, care must be taken not to scratch the polished surface of the mirror with the abrasive, and to be sure to center the brass disk properly over the hole already drilled from the back. A coat of varnish or lacquer will help to prevent scratching, and may easily be removed with a suitable solvent later. Some amateurs, after drilling through from the back, remove the central plug with a sharp hammer blow from the front surface. Others (including the author) have never developed sufficient courage to do this.

The required minimum size of the hole is given by

$$s = \frac{p\,(A-b)}{F'} + b. \qquad (5)$$

If a shielding tube is to be used, the hole must be made larger than this.

Mounting. One of the undesirable features of the Cassegrainian is that the eyepiece is pointed directly at the sky and the field of view is therefore especially subject to stray light. To avoid this, it is desirable to shield the tube (if it is a lattice construction) for a considerable distance above the primary mirror. It may also be desirable to introduce a short

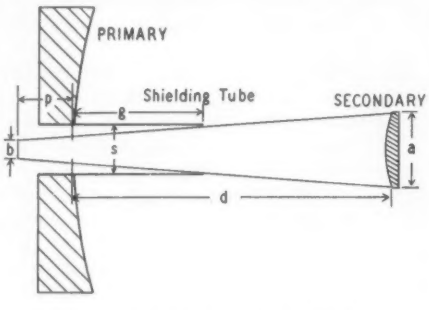

Fig. 5. Shielding the perforation.

length of tube as shown in Fig. 5 to prevent direct sky light from entering the hole in the primary. As an added precaution here, the secondary mirror should always be somewhat larger than the hole in the primary. The length of the shielding tube, **g**, is given by the equation:

$$g = \frac{(d+p)\,(s-b)}{a-b} - p. \qquad (6)$$

The Cassegrainian, because of its stubby tube, is well adapted to the fork type of mounting, although this may lead to difficulties in observation of the polar regions.

Because the eyepiece frequently gets into inconvenient observing positions, it is usually fitted with a diagonal, such as is commonly used with eyepieces on refracting telescopes, and often referred to as a zenith eyepiece or star diagonal.

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OBSERVER'S PAGE

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The Visibility of the Planets — III

THE SUPERIOR PLANETS present an entirely different aspect from Venus and Mercury. (See the June and July issues.) First, all the superior planets have only one conjunction with the sun in a synodic period. After conjunction, the planet moves away from the sun into the morning sky, and western quadrature occurs when it is 90° from the sun. When its celestial longitude differs from the sun's by 180°, opposition occurs, but note that the planet need not be exactly opposite the sun in the sky. The planet is always brightest at opposition, and is dimmer before and after, as can be seen from the accompanying graph for Mars and Jupiter. Eastern quadrature occurs in the evening sky when the planet is 90° in longitude east of the sun. We shall consider Mars first.

Because Mars is the nearest superior planet, it runs the closest race with the earth, and has the longest synodic period, 780 days or almost two years and two months. The planets beyond have progressively shorter and shorter synodic periods because of their slower speeds and greater distances. Pluto moves the slowest and has the greatest distance to move.

Mars has great magnitude variations. Near conjunction it may be as dim as Polaris, of the 2nd magnitude. At opposition it may range from −1.1 to −2.8, depending on its distance from the sun and the earth. Oppositions in February are the poorest, for Mars is far from the earth then. This year opposition occurred in January, so the fiery planet was no brighter than −1.2. The most favorable oppositions come in late August or thereabouts; this happened in 1939 and will again occur in 1955 and 1957.

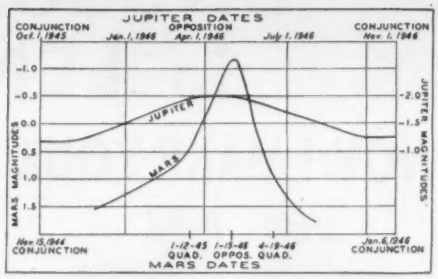
Mars is visible to the naked eye some time every night for 18 to 20 months between conjunctions; this is the longest for any planet. It moves rapidly when close to the sun, and as the apparent distance increases Mars appears to slow down. Before opposition the planet appears to stop entirely as the earth begins to pass it. The planet seems to move westward — retrograde — while passing through opposition. The retrograde motion usually occupies about 16° in the sky.

Near conjunction, the rapid motion keeps Mars near the sun and invisible for a long time, six months at least, and more than any bright planet. This year, southern observers can follow Mars until mid-autumn as it approaches conjunction next January. For northern observers, Mars will have disappeared into the evening twilight before summer ends. The reason is, of course, that Mars is south of the sun in declination and thus sets much earlier for observers up north.

Mars' faintness at conjunction aids in keeping it invisible a long time — very little change in magnitude takes place for many months. Not before two to four months after conjunction may Mars be viewed just before sunrise. Quadrature does not occur until 10 or 11 months after conjunction, but at this time the magnitude is increasing rapidly, as shown on the graph. (Jupiter's variations are much slower and smoother.) Opposition comes three months later. Conditions are reversed after opposition back to conjunction 13 months later.

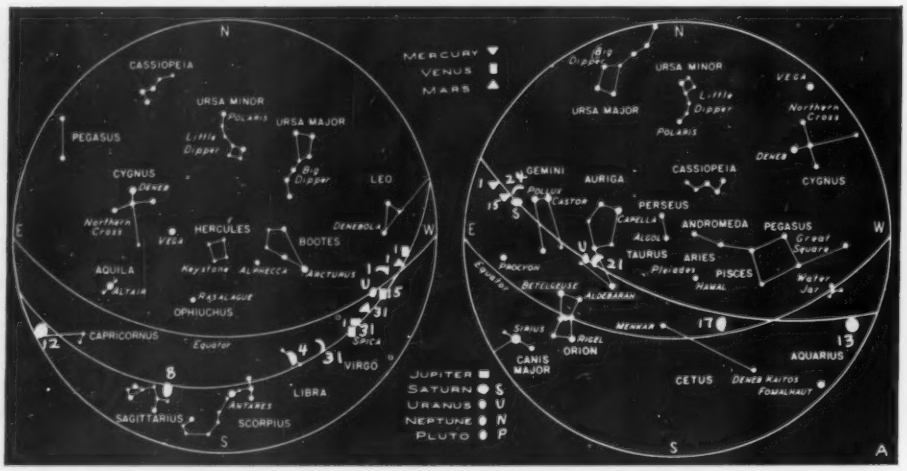
As Mars' sidereal period is 687 days, during one synodic period it traverses each constellation of the zodiac at least once.

EDWARD ORAVEC



Brightness changes of Mars and Jupiter. Note the different scales.

THE MOON AND PLANETS IN THE EVENING AND MORNING SKIES



In mid-northern latitudes, the sky appears as at the right at 5:30 a.m. local time on the 7th of the month, and at 4:30 a.m. on the 23rd. At the left is the sky for 9:30 p.m. on the 7th and 8:30 p.m. on the 23rd. The moon is shown for certain dates by symbols which give roughly its phase. Each planet has a special symbol, and is located for the middle of the month, unless otherwise marked. The sun is not shown, although at times it may be above the indicated horizon. Only the brightest stars are included, and the more conspicuous constellations.

Mercury enters the morning sky on August 2nd, moves rapidly away from the sun, and becomes visible about August 15th as a star of magnitude 1.0. It gets brighter all month, reaching greatest elongation on the 20th, rising 1½ hours ahead of the sun. On August 31st, it will be of magnitude −0.9.

Venus grows brighter in the western sky, but its position is unfavorable for northern observers. It is in conjunction with Mars on the 9th, about 5 magnitudes brighter than the red planet. On the 31st, at 0h GCT, Venus will be only ¼° north of Spica.

Mars, located in western Virgo, is becoming more difficult to see in the evening twilight. By the 31st, it will be a few degrees west of Venus, Jupiter, and Spica.

Jupiter remains near Spica low in the west after sunset; this is the last opportunity to observe its satellites before conjunction. (See page 15.)

Saturn. About the 12th of August the planet may be seen rising 1½ hours ahead of the sun, which increases to three hours by the end of the month.

Uranus is in Taurus.

Neptune is too near the sun to be seen.

E. O.

OCCULTATION OF VENUS REPORTS

IN ADDITION TO the report from Texas printed on page 20 of the July issue, we have received several accounts of the occultation of Venus on June 1st. W. A. Hartman, 214 Weaver St., San Antonio, writes in part:

"The observations of the occultation of Venus in San Antonio were successful, although heavy clouds in the north had us worried if the city was due for another heavy hail storm as in the few weeks past, when the stones measured from nine to 12 inches in circumference. At about the time of first contact, the moon and Venus were close to 50 degrees from the western horizon; however, not too difficult to find with the naked eye.

"A. G. Albin, 523 Vanderbilt St., using WWV time, a 6-inch reflector, and a stop watch, clocked first contact at 18:25:25, with second contact 20 seconds later. At 19:28:10 Venus began to reappear, taking 30 seconds to do so.

"Capt. P. H. Horton, U. S. Army, residing at 805 Camden St., and with a 6-inch reflector also, obtained 18:24:50 for first contact, and 40 seconds for immersion to be complete. His third contact was 19:28:15, with 30 seconds for emersion. He used telephone service time, and determined position angles as about 75° and 335°. Ft. Worth position angles were 60° and 315°.

"The 7x50 binoculars I use when at the

fire station showed immersion at 18:25 and emersion at 19:29, using the time of the police and fire department radio."

Mr. Hartman also described observations of Mars made by him and Capt. Horton on June 2nd, using his 10-inch reflector of 84 inches focus. He found the northern ice cap of the planet still outstanding, and the south pole seemed completely in the dark.

From Napa, Cal., Frank Trathen, of 2694 Linda Vista Ave., writes that bad weather broke on the morning of the occultation, and that at noon he had no trouble seeing the moon and Venus with the naked eye. The occultation was perfect, and he judged immersion and emersion each to have required about a minute.

Robert E. Millard, of 3908 Council Crest Drive, Portland, Ore., reports:

"Few astronomical spectacles are more beautiful than an occultation of Venus by the crescent moon when seen against the dark sky, such as the one I observed on the early morning of August 26, 1924. The same phenomenon on June 1st this year awakened pleasant memories and aroused my interest in observing the event."

Partly cloudy skies and poor seeing spoiled first contact, but Mr. Millard did time the disappearance of the last "bobbing blob of light" at 3:46:03.3 PST. The occultation lasted 45 minutes at his station.

At Palo Alto, Cal., Dr. Henry Power, of 356 Coleridge Ave., and Walter Smith used an 8-inch telescope and a stop watch checked with short-wave time signals 12 minutes after immersion. Dr. Power writes:

"At the time of occultation, the distance to Venus was close to 609 times the distance to the moon. The speed of the moon was 3,350 feet per second. Taking the diameter of Venus as 7,575 miles the moon should cover or uncover the planet in 19.6 seconds, during which time the moon will move 12.5 miles.

"Time of immersion for this point calculated from the **Ephemeris** is 23:38:07.7 GCT, and final loss of light was observed at 23:38:28.8. My latitude is 37° 26′ 18″.4 north, longitude 122° 8′ 45″.6 west.

"During half an hour before immersion we examined the planet and moon frequently and at no time was any color noted — our eyepiece is natural quartz. At emersion, however, the planet seemed far brighter than the moon and during the few seconds following this was even more marked and there was distinct yellow color. Then I made the remark that it looked like a fire on the moon as the west edge of the planet was undoubtedly red. I continued at the scope and shortly all this was lost and Venus was the usual milky white disk we are accustomed to see in the daytime.

"These findings may be of use in forming an opinion as to the presence of gas or water vapor under certain circumstances; the occultation was nearly 53 hours after new moon so that the sun had opportunity to warm the west edge of the moon to some extent. Thus it would seem to differ from conditions at the time of an eclipse of the sun."

VARIABLE STAR MAXIMA

These predictions of variable star maxima are made by Leon Campbell, recorder of the A.A.V.S.O., Harvard College Observatory, Cambridge 38, Mass. Serious-minded observers interested in making regular telescopic observations of variable stars may write to Mr. Campbell for further information.

Only stars are included here whose mean maximum magnitudes, as recently deduced from a discussion of nearly 400 long-period variables, are brighter than magnitude 8.0. Some of these stars, but not all of them, are nearly as bright as maximum two or three weeks before and after the dates for maximum. The data given include, in order, the day of the month near which the maximum should occur, the star name, the predicted magnitude, and the star designation number, which gives the rough right ascension (first four figures) and declination (bold face if southern).

August 3, T Centauri, 6.1, 133**63**3; 4, R Serpentis, 6.8, 154615; 6, T Aquarii, 7.9, 204**405**; 8, RU Sagittarii, 7.2, 195**142**; 11, X Monocerotis, 7.6, 065**208**; 12, U Ceti, 7.5, 022**813**; 19, RT Cygni, 7.4, 194048; 26, W Andromedae, 7.5, 021143a; 27, R Aquilae, 6.3, 190108; 28, S Coronae Borealis, 7.5, 151731. September 4, T Ursae Majoris, 7.9, 123160; 5, T Hydrae, 7.7, 085**08**.

For Jupiter's satellites, see page 15; for news of comets, see page 10.

GREENWICH CIVIL TIME (GCT)

TIMES used on the Observer's Page are Greenwich civil or universal time, unless otherwise noted. This is 24-hour time, from midnight to midnight; times greater than 12:00 are p.m. Subtract the following hours to convert to standard times in the United States: EST, 5; CST, 6; MST, 7; PST, 8. If necessary, add 24 hours to the GCT before subtracting, and the result is your standard time on the day preceding the Greenwich date shown. To convert standard time to daylight saving time, add one hour.

PHASES OF THE MOON

First quarter .....August 4, 20:55
Full moon .....August 12, 22:26
Last quarter .....August 20, 1:17
New moon .....August 26, 21:07
First quarter .....September 3, 14:49

MINIMA OF ALGOL

August 3, 13:25; 6, 10:14; 9, 7:02; 12, 3:51; 15, 0:39; 17, 21:28; 20, 18:16; 23, 15:05; 26, 11:54; 29, 8:42. September 1, 5:31; 4, 2:19.

OCCULTATION PREDICTIONS FOR AUGUST

Rarely is an occultation listed at all eight stations for which our predictions are made. The case of Tau Aquarii, occulted the night of August 13-14th, shows all stations for immersion and all but one for emersion. As this is a 4th-magnitude star, observers everywhere in the country have an opportunity to observe the event, although some optical aid will be needed in view of the brightness of the moon.

The hiding of Xi¹ Ceti on the 17-18th is nearly as favorable. The first two occultations listed are also of 4th-magnitude stars, although only for observers west of the Mississippi.

3-4 **Kappa Virginis** 4.3, 14:10.0 −10-01.4, 6, +80° +9° Im: **F** 5:26.7 −0.3 −1.7 120°; **G** 4:42.8 −0.9 −1.6 85°; **H** 5:00.2 −1.2 −1.7 107°; **I** 4:35.3 −1.2 −1.5 91°. Em: **H** 6:12.0 −0.6 −1.9 301°.

7-8 **b Ophiuchi** 4.3, 17:23.1 −24-07.6, 10, +66° +8° Im: **F** 6:04.2 −1.8 −1.6 111°; **G** 5:17.0 −1.6 −0.5 69°; **H** 5:10.8 −2.5 −0.4 91°; **I** 5:01.6 −1.9 0.0 72°. Em: **F** 7:17.2 −0.5 −0.5 251°; **H** 6:42.4 −1.9 −1.4 285°.

9-10 **Psi Sagittarii m** 4.9, 19:12.2 −25-21.1, 12, +59° −3° Im: **F** 7:31.6 −1.5 −0.7 83°; **G** 7:19.5 ... ... 9°; **H** 6:56.3 −1.8 +1.0 42°. Em: **F** 8:46.0 −0.5 −0.4 250°; **H** 8:06.3 −2.5 −1.8 299°.

13-14 **Tau Aquarii** 4.2, 22:46.7 −13-52.7, 16, +77° +1° Im: **A** 8:57.3 −2.0 −2.3 110°; **B** 8:49.7 −1.6 −1.5 97°; **C** 8:54.8 −2.6 −2.6 114°; **D** 8:42.4 −1.8 −1.1 92°; **E** 8:22.5 −2.0 −0.2 81°; **F** 8:07.3 −3.0 −0.2 93°; **G** 7:56.9 −1.0 +1.3 32°; **H** 7:25.2 −1.6 +1.8 48°; **I** 7:45.9 −1.0 +1.8 24°. Em: **A** 9:40.2 +0.3 +1.8 188°; **C** 9:33.7 +0.6 +2.7 183°; **D** 9:41.7 −0.3 +0.9 205°; **E** 9:33.1 −0.7 +0.8 213°; **F** 9:14.1 −0.6 +2.1 197°; **G** 9:03.5 −1.8 −0.1 270°; **H** 8:47.1 −2.2 +0.7 252°; **I** 8:46.2 −2.0 +0.2 280°.

17-18 **64 Ceti** 5.7, 2:08.5 +8-19.1, 20, +90° +7° Em: **A** 9:09.7 ... ... 163°; **C** 8:53.7 ... ... 156°; **D** 9:16.4 −0.4 +3.0 189°; **E** 9:00.1 −0.7 +2.5 202°; **F** 8:28.8 −0.2 +3.1 190°; **G** 8:59.7 −0.9 +1.6 253°; **H** 8:29.4 −0.6 +1.8 238°; **I** 8:49.9 −0.7 +1.6 261°.

17-18 **Xi¹ Ceti** 4.5, 2:10.1 +8-35.7, 20, +90° +1° Im: **A** 9:55.3 −3.9 −3.8 125°; **C** 9:54.6 ... ... 140°; **D** 9:32.6 −2.5 −0.5 102°; **E** 9:05.4 −2.1 +0.7 89°; **F** 8:43.3 −2.5 +0.4 100°; **G** 8:56.9 −0.5 +2.0 39°; **H** 8:24.0 −0.5 +1.9 54°; **I** 8:50.4 −0.3 +2.2 31°. Em: **A** 10:24.7 ... ... 170°; **C** 10:05.7 ... ... 157°; **E** 10:09.8 −0.8 +2.4 203°; **F** 9:36.7 −0.2 +3.4 186°; **G** 10:00.2 −1.3 +1.2 259°; **H** 9:30.7 −1.1 +1.7 242°; **I** 9:47.1 −1.2 +1.3 269°.

19-20 **163 B Tauri** 5.8, 3:57.7 +18-02.6, 22, +90° +20° Em: **E** 8:25.8 +0.5 +3.3 189°; **G** 8:49.8 −0.1 +1.8 240°; **I** 8:46.9 0.0 +1.7 246°.

22-23 **Omega Geminorum** 5.2, 6:59.1 +24-17.7, 25, +89° +17° Em: **A** 7:51.3 0.0 +1.3 263°; **B** 7:55.1 0.0 +1.2 271°; **D** 7:53.1 −0.1 +1.1 273°.

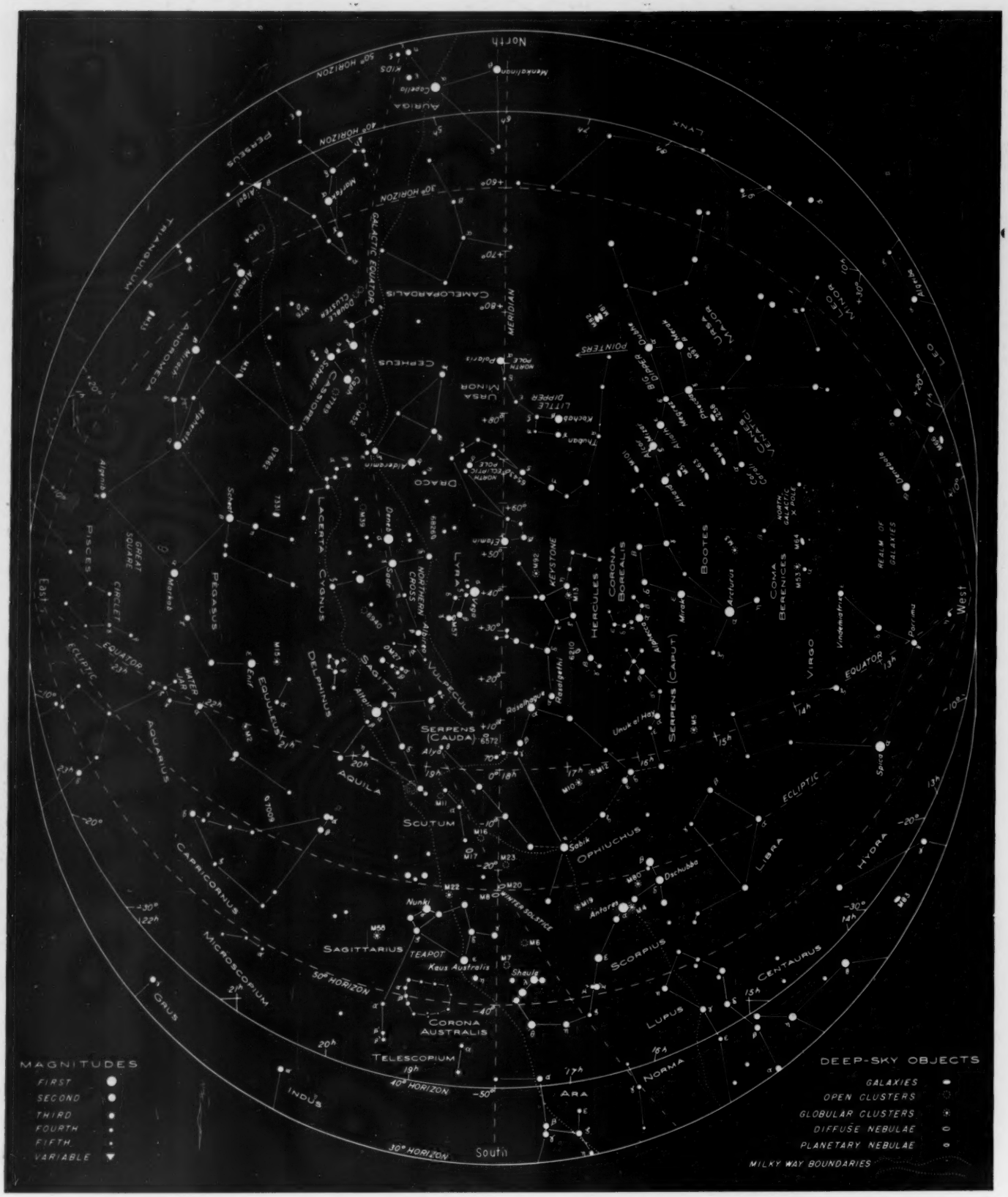
For selected occultations (visible at three or more stations in the U. S. and Canada under fairly favorable conditions), these predictions give: evening-morning date, star name, magnitude, right ascension in hours and minutes and declination in degrees and minutes, moon's age in days, limiting parallels of latitude, immersion or emersion; standard station designation, GCT, a and b quantities in minutes, position angle; the same data for each standard station westward.

Longitudes and latitudes of standard stations are:

A +72°.5, +42°.5	**E** +91°.0, +40°.0
B +73°.6, +45°.6	**F** +98°.0, +30°.0
C +77°.1, +38°.9	**G** +114°.0, +50°.9
D +79°.4, +43°.7	**H** +120°.0, +36°.0
	I +123°.1 +49°.5

The a and b quantities tabulated in each case are variations of standard-station predicted times per degree of longitude and of latitude respectively, enabling computation of fairly accurate times for one's local station (long. Lo, lat. L) within 200 or 300 miles of a standard station (long. LoS, lat. LS). Multiply a by the difference in longitude (Lo — LoS), and multiply b by the difference in latitude (L — LS), with due regard to arithmetic signs, and add both results to (or subtract from, as the case may be) the standard-station predicted time to obtain time at the local station. Then convert the Greenwich civil time to your own standard time.

For additional occultations consult the American Ephemeris and Nautical Almanac and the British Nautical Almanac, from which these predictions are taken. Texas predictions were computed by E. W. Woolard and Paul Herget.



DEEP-SKY WONDERS

SAGITTARIUS is the amateur's treasure chest. If all other constellations were cloud-covered, this one group would be enough, because it provides specimens of all major marvels except galaxies, with at least 19 wonders suitable for amateurs.

Besides planetary NGC 6818 (51¼), 19h 40m, −14° 18′, these objects include:

Nine globulars. M28, 18h 21m.2, −24° 54′. M69, 18h 27m.7, −32° 23′. NGC 6652, 18h 32m.2, −33° 02′. M22, 18h 33m, −23° 58′. M70, 18h 39m.6, −32° 21′. M54, 18h 51m.6, −30° 33′. NGC 6723, 18h 55m.8, −36° 43′. M55, 19h 36m.6, −31° 04′. M75, 20h 02m.9, −22° 04′.

Six clusters. M23, 17h 51m, −19° 00′. M21, 17h 58m.6, −22° 30′. M24, 18h 12m.6, −18° 27′. M18, 18h 14m.1, −17° 10′. M25, 18h 25m.8, −19° 19′. NGC 6645 (23⅚), 18h 26m.8, −16° 58′.

Three nebulosities. M20 (Trifid), 17h 57m.5, −23° 02′. M8 (Lagoon), 17h 58m.8, −24° 23′. M17 (Omega or Horseshoe), 18h 15m, −16° 13′. L. S. COPELAND

STARS FOR AUGUST

from latitudes 30° to 50° north, at 9 p.m. and 8 p.m., local time, on the 7th and 23rd of the month, respectively. The 40° north horizon is a solid circle; the others are circles, too, but dashed in part. When facing north, hold "North" at the bottom, and similarly for other directions. This is a stereographic projection, in which the flattened appearance of the sky itself is closely reproduced, without distortion.

EVENING STARS FOR SOUTHERN OBSERVERS

THIS CHART is prepared for a basic latitude of 30° south, but it may be used conveniently by observers 20 degrees on either side of that parallel. These southern charts appear in alternate months, but always two or three months in advance, to allow time for transmission to observers in any part of the world. The sky is here shown as it appears on Oct. 7th at 11 p.m., Oct. 23rd at 10 p.m., Nov. 7th and 23rd at 9 p.m. and 8 p.m., respectively. Times for other days vary similarly, four minutes earlier per day. These are local mean times which must be corrected for standard time differences. The 30° horizon is a solid circle; the other horizons are circles, too, those for 20° and 40° south being dashed in part. When facing south, hold "South" at the bottom, and similarly for other directions. Observers in the tropics may find north circumpolar stars on any of our northern star charts. For other charts in this series, see issues of alternate months, October, 1944, to June, 1945, and September, 1945, to the present.